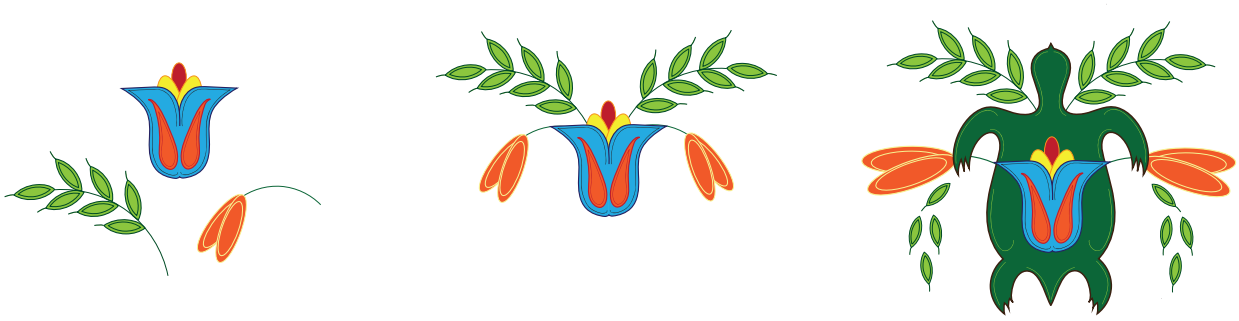
Expanding the Narrative of Tribal Health:

The Effects of Wild Rice Water Quality Rule Changes on Tribal Health

Fond du Lac Band of Lake Superior Chippewa

Health Impact Assessment



This is a translation of the manoomin stalk, its flowering, and its reseeding. I made this design to recognize how we both carry and care for the Manoomin. It is our gift but also our responsibility. My teaching is that our florals are meant to tell and teach our stories.

Sarah Agaton-Howes, Artist

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The information expressed herein is that of the Fond du Lac Band of Lake Superior Chippewa Resource Management Division

1. Executive Summary

Manoomin and all the health benefits and wealth that it creates are under threat from a variety of human stressors, after substantially declining from its historic range. The state of Minnesota has proposed revisions to their water quality standards for wild rice that the tribes believe would be less protective of manoomin and lead to further decline. Minnesota tribes are understandably concerned that any further declines in this critical cultural and natural resource will disproportionately affect tribal members' and tribal communities' health and well-being.

Fond du Lac has experienced challenges in documenting and publicizing the impacts to community health, social cohesion, access to healthy food, equity, and other important issues related to the degradation of wild rice. **The primary purpose of this HIA is to clearly and simply articulate the importance of manoomin to the health of the Ojibwe people.** Our intent is to support the implementation and enforcement of broadly protective wild rice water quality regulations, and make additional recommendations for sustaining manoomin in Minnesota **because of the fundamental importance of manoomin to tribal health.**

Subsistence living and maintaining cultural practices, through the exercise of treaty rights, are how modern tribal members preserve links to their ancestral generations. Within the Anishinaabe worldview, the health of manoomin and the health of the people are inseparable. Any disruption in indigenous land, place or culture clearly has a potentially harmful effect on indigenous health and wellness, which then may persist for generations to come.

The social determinants of health are the conditions in which people are born, grow, live, work and age. They are shaped by the distribution of money, power and resources at global, national and local levels, and are mostly responsible for health inequities—the unfair and avoidable differences in health status seen within and between countries or communities. Health Impact Assessment (HIA) assumes that the majority of our health (approximately 60-80%) is determined by *factors that can be changed*—social, economic and political factors; natural and built environmental conditions; living and working conditions; and individual behaviors—through policies, programs and projects that consider health. Establishing health equity within American Indian communities means supporting not only access to services and provisions like health care and healthy foods, it also means protecting and supporting resilient cultural and spiritual practices that connect people to their faith and identity.

At the onset of this HIA, tribal community surveys uncovered several strong themes:

- **identity**-manoomin is central to Anishinaabe identity and preservation of culture
- **social relations**-manoomin contributes to bonding, traditions and strengthening family and community connections
- **health**-manoomin is a healthy, traditional food source and medicine
- **environment**-manoomin provides important connections to the earth and needs clean water to survive
- **enjoyment**-manoomin tastes good
- **activity**-harvesting and eating manoomin are activities that are important to the Anishinaabe.
- **management**-survey respondents expressed concerns regarding the protection and management of manoomin
- **supply**-survey participants stated that having a good supply of manoomin meant food security to them.

Native Americans experience poorer health outcomes, including double the rate of heart disease compared to other populations, higher rates of obesity, the highest rates of high blood pressure, cholesterol, and Type II diabetes of any racial group in the country, and are twice as likely to die from diabetes. Diabetes rates are rising among Native American children more rapidly than any other group. Additionally, food insecurity further increases the risk of heart disease, obesity, and diabetes.

Hand-harvested manoomin is a traditional staple food that provides irreplaceable cultural and nutritional benefits. In addition to wild rice's cultural importance, wild rice's overall nutritional content is superior to other types of rice. Given the prevalence of diabetes, insulin resistance and cardiovascular disease in Minnesota's Native American population, wild rice's comparatively low glycemic index may offer a significant health advantage over other foods. The physical activity associated with traditional food gathering, combined with the high nutritional value may offer great benefits to decreasing risks of chronic disease.

Connections to land and food are key components of culture and health for many Ojibwe people. Social and economic conditions are also identified as root causes of health disparities for American Indians not only by adversely affecting health behaviors, but also by creating toxic stressors that physiologically harm the body. Pathways that link environmental and ecological harm to negative impacts on human health are likely amplified for Indigenous communities and are one important driving factor of health disparities.

On the other hand, protection, revitalization, and engagement in cultural traditions can promote Indigenous health. Cultural factors such as Indigenous language fluency rates, participation in ceremonies and cultural activities, and connection to land are associated with better health outcomes. Access to sustainable populations of manoomin is critical for maintaining food security for Minnesota tribes, and is central to the affirmation of food sovereignty through exercise of treaty harvesting rights. If the availability or access to harvestable stands of manoomin is diminished, tribal members' health and sociocultural well-being will become further compromised.

In addition to researching the social determinants of health and key assessment areas, Fond du Lac contracted with Earth Economics to conduct an economic analysis of the benefits of manoomin harvesting to the tribal communities' and the state's economies. Managing and restoring sustainable populations of manoomin across Minnesota supports economic security for tribal members and tribal communities. The annual harvest results in $12.5 million in expenditures, and the sale of hand-harvested manoomin supports more than $19.2 million in annual income for tribal harvesters, while the annual spending associated with manoomin harvesting supports about 153 local jobs and the annual income generated by the sale of manoomin supports an additional 125 jobs.

While the cultural and sustenance reasons for protecting and restoring manoomin should be evident, natural wild rice beds also represent unique, valuable, and complex aquatic ecosystems, and support an abundance of wildlife and waterfowl. Today, the range of natural stands of wild rice is profoundly diminished from their historic distribution, due to multiple and cumulative effects of land use changes and altered hydrology, pollution, invasive species, and now global climate change. Although wild rice remains a significant cultural, subsistence, and economic resource for Minnesota, there are few regulatory protections in place. Ensuring the sustainability of this invaluable aquatic resource will require research and funding for effective restoration and habitat protection, and necessitates broader regulatory protections.

All of the lifeways we examined in the HIA showed negative impacts to tribal health and manoomin (see Table 1). Key recommendations for promoting tribal health and protecting manoomin include:

- promoting manoomin and manoomin harvesting as an important part of a healthy diet and healthy lifeways;
- expanding access to manoomin in nutritional assistance programs and seeking new opportunities to serve manoomin in the community;
- increasing food security and food sovereignty in tribal communities through treaty harvest of manoomin and supporting the healthy ecosystems it depends upon;
- elevating public awareness about the ecological, nutritional and cultural values of manoomin;
- promoting a comprehensive and protective regulatory framework for wild rice waters that involves both the MPCA and MNDNR;
- implementing a concerted effort to inventory all wild rice waters in Minnesota; implementing a coordinated and standardized monitoring and assessment program for wild rice waters across the state and engaging citizen scientists/volunteer monitors to help accomplish that;
- continued research into climate change impacts and manoomin ecology, as well as additional health and nutrition studies.

Aubrey, Grade 2

Determinants of Health & Human Health Outcomes From a Loss of Manoomin	Impact on Human Health	Magnitude	Likelihood	Quality of Evidence
Decreases in ability to exercise Treaty rights to collect manoomin	Negative	All tribal members	Likely	*
Decreases in Indigenous voices in decisions	Negative	All tribal members	Likely	*
Decreases in social cohesion or connectedness to community	Negative	All tribal members	Likely	* *
Decreases in cultural and spiritual practices	Negative	All tribal members	Very likely	* *
Decreases in native language vocabulary	Negative	All tribal members	Likely	* *
Increases in mental illnesses, including depression	Negative	All tribal members	Likely	* *
Decreases in physical activity	Negative	Tribal members who participate in manoomin gathering, finishing and ceremonies for manoomin	Very likely	* *
Decreases in healthy diet and nutrition	Negative	Tribal members who eat manoomin	Likely	* * *
Increases in chronic diseases, including obesity, heart disease, and diabetes	Negative	Tribal members who participate in manoomin gathering, finishing, eating and ceremonies for manoomin	Likely	* *
Decreases in food sovereignty	Negative	All tribal members	Likely	*
Decreases in food security	Negative	Tribal members who eat manoomin	Likely	* *
Decreases in jobs related to manoomin collection and processing	Negative	278 jobs from direct and indirect spending: every 1% loss of manoomin equals a loss of 2 jobs	Likely	* * *
Decreases in income related to the sale of manoomin	Negative	Every 1% decrease in harvested manoomin results in $277,523 less proprietor income	Likely	* * *
Decreases in healthcare costs avoided (i.e., increases in healthcare costs)	Negative	Tribal members who eat manoomin; for every 1% decrease in consumption there is $2,638 in additional unavoided healthcare costs	Likely	* * *
Decreases in manoomin for gifting (reduced cultural practice)	Negative	Tribal members who rice and tribal members who receive manoomin gifts	Likely	*

Table 1: Determinants of Health and Human Health Outcomes from a Loss of Manoomin

Stressors on the Health of Manoomin	Impact on Health of Manoomin	Magnitude	Likelihood	Quality of Evidence
Invasive species	Negative	Declining manoomin opens up habitat for both native and non-native species, which out-compete manoomin and make restoration difficult	Very likely	* * *
Climate change	Negative	Can impact germination, growth, reproduction phases of life cycle; floods and extreme storm events can destroy a year's production; droughts can stress plants and make harvest impossible	Very likely	* * *
Hydrologic modification	Negative	Damming and draining can both impact manoomin, as it is exceptionally sensitive to water level fluctuation	Very likely	* * * *
Pollution	Negative	Extensive recent experimental evidence for sulfide (reduced sulfate) toxicity; intolerant of high turbidity, sedimentation, nutrient enrichment	Likely	* * * *
Development	Negative	Degrades habitat; increases human and motorized traffic, which can uproot plants. Shoreline property owners often remove wild rice plants even though it is not permitted per MN DNR	Very likely	* * *

Probability:	
Not likely	(0-49% likelihood)
Likely	(50-75% likelihood)
Very likely	(76%-100% likelihood)

Quality of Evidence:	
*	Traditional knowledge or a few studies (only qualitative evidence)
* *	Traditional knowledge & a few studies (only qualitative evidence)
* * *	Traditional knowledge & several studies (including modeled output)
* * * *	Traditional knowledge & several studies (quantitative evidence)

Table 2: Stressors on the Health of Manoomin

2. Introduction: Expanding the Narrative of Tribal Health

It's in our stories – it brought us here – it's the life of us.

2.1 The Beginning

According to oral traditions, more than a thousand years ago seven spirits or Grandfathers came to the Anishinaabe people living on the Atlantic coast, from the mouth of the St. Lawrence River south into Maine and New England states. They delivered seven prophecies, including the impending coming of the white race, which they believed would threaten their existence and separate them from their land, their culture and their identity. In order to survive and preserve their ways of life, the Anishinaabeg migrated westward through the Great Lakes basin, guided by the prophecies that led them to the place where food grew up out of the water.[1] That food was wild rice or manoomin, the "good berry"; the only grain native to North America. They found manoomin growing in the waters of tributaries, lakes and coastal areas of Lake Superior, and established a new homeland here, depending upon the harvest and preservation of this highly nutritious food to survive the long winters. Today, it remains a dietary staple for the Ojibwe people, as much medicine as it is food, with cultural and spiritual importance and a necessary offering at community feasts and ceremonies.

There is some comfort in believing we have always been in the places that we now call home. We know however, that the Ojibwe communities in which we live, be they Odana, Lanse, Red Cliff, White Earth, or Turtle Mountain, are all relatively new in the long story of our people. Many of the stories that explain our migration to these contemporary places remind us that we may have been here once before, in a time now hidden somewhere in our ancestral memory. We do know that much of contemporary Ojibwe country was covered with a sheet of ice several miles thick nearly twelve thousand years ago during the last glacial period. With the retreat of the ice came the return of plants – trees and grasses and flowers. Then our elder brothers, the four-leggeds and birds, called this home. Then the people of other nations called this home, the Cheyenne, Blackfeet, Dakota, Fox, and Menominee.

The ancestors of the Ojibwe were the Lenni Lenape (known today as the Delaware), the Grandfathers, who migrated across this great continent from the west to the east[2]… More recently, our ancestors began a westward migration as one people with the Ottawa and Potawatomi only to split and become separate nations along the way. This journey eventually led us to Madeline Island (just offshore Red Cliff, Wisconsin).[3]

Nenabozho, our Great Uncle, was the first to find manoomin. Hungry, Nenabozho visited his friend Zhiishiib (Duck) for food. Zhiishiib served Nenabozho with manoomin naboob (soup). It was the most delicious naboob Nenabozho had ever eaten. Later, Nenabozho set out to find the food the Zhiishiib had served him. After several days, Nenabozho, hungry, followed a flock of ducks to a lake. He found tall slender plants growing from the water. "Eat us, Nenabozho," the plants said. "We're good to eat." Eating some, he realized it was the food Zhiishiib had given him. "What do you call yourselves?" Nenabozho asked the beautiful plants. "We are called manoomin, Nenabozho," the manoomin aadizookaanag (spirit) answered.[4]

2.2 Traditional Way of Life in a Modern World

Our reservation was physically put here to save wild rice beds. We are here to live a life of Manoomin.

The Anishinaabeg is the preferred name for culturally related indigenous peoples in Canada and the United States, including Ojibwe or Chippewa people, meaning "one of the people" or "original people." The traditional economic cycle for the Anishinaabeg is grounded in the seasons and the natural wealth of the land and waters. For example, Manoominike Gizis (September) is the name of the month to gather manoomin (wild rice). For generations, the family would work together to prepare for this "gift" of manoomin that would nourish their bodies and sustain their lives, through communion with each other and embracing the season that brings all the traditions of preparation for this gift to their community. But things have changed.

Manoomin and all the health benefits and wealth that it creates are under attack from a variety of sources. Many of these sources stem from the modern socio-economic paradigm that sees manoomin as a natural resource of little consequence or to be exploited through industrial farming, instead of as a critical spiritual, cultural and nutritional species that deserves reverence and protection. This foreign socio-economic paradigm has forced tribal members to become disassociated from traditional lifeways that were natural, that allowed the flow of life to shape the way passage of time influenced daily and seasonal life-supporting activities. Modern life, controlled by the dominant socio-economic structure, has disrupted the communion (relationship) and traditions associated with the land, spirit and manoomin that have served the Anishinaabeg since the beginning. In current times our communion is expressed through the monetary system, which is a disjunction or severing of the traditional Anishinaabe ethic of respectful reciprocity that has sustained relationships between water, plants, people and community for countless generations.

2.2.1 Background on Manoomin Water Quality Standards Context

For millennia, Minnesota tribes have been physically and spiritually sustained by their harvest and consumption of wild rice (*Zizania palustris*, *Zizania aquatica*), known as *manoomin* to the Ojibwe and *Psiŋ* to the Sioux or Dakota people. Manoomin is considered sacred, a gift from the Creator; it is essential to tribal subsistence culture, diet, and traditions. Wild rice is also an important food source for resident and migratory waterfowl, and provides forage and cover for many other wildlife species indigenous to this ecoregion, making it a keystone species in the water-rich landscape of the upper Midwest.

The wild rice harvest is still one of the most important annual events on many Native American reservations and across ceded territories, where tribes retain hunting, fishing and gathering rights protected by treaties. This unique and nutritious grain was once widely distributed across much of the United States east of the Rockies. However, since European contact and the westward expansion of American settlement, most of the specific wetland and aquatic habitat that wild rice requires has been developed, altered or degraded. Today, natural wild rice only grows abundantly in north central and northeastern Minnesota, areas of northern Wisconsin, and in small remnant stands in Michigan. From historical reports,[5] Band member accounts,[6] and current Minnesota Department of Natural Resources and tribal reports,[7] manoomin has extensively declined throughout Minnesota, and in southern Minnesota it has virtually disappeared because of dramatic transformations of the landscape and alterations of natural hydrology over the last century. Many tribes across this region of the western Great Lakes are zealously working to protect and restore the remaining stands of wild rice on their reservations and within their ceded territories. But for other tribes in this region, the resource has already disappeared, along with the cultural connections, language and traditional knowledge associated with it.

> *We object to the exploitation of our wild rice for pecuniary gain…We are of the opinion that the wild rice rights assured by treaty accrue not only to individual grains of rice, but to the very essence of the resource.*
>
> *Norman Deschampe*

For the purposes of this Health Impact Assessment (HIA), a distinction must be made between natural manoomin and cultivated (paddy) wild rice. The University of Minnesota has a long history of working with farmers, marketers and processors to develop wild rice as a commercial agricultural commodity raised in paddies. Since 1978, the university has invested in selective breeding to develop multiple strains of wild rice that are more efficiently cultivated and mechanically harvested. By the late 1980s, more than 95% of commercially marketed wild rice was cultivated and mechanically harvested, with California and Minnesota leading in the production. Also in the 1980s, the university supported mapping of the wild rice genome, over the strenuous objections of Minnesota tribes.

In 1998, Norman Deschampe, then Minnesota Chippewa Tribal President, sent a letter to University of Minnesota President Mark Yudof, stating: "We object to the exploitation of our wild rice for pecuniary gain…We are of the

opinion that the wild rice rights assured by treaty accrue not only to individual grains of rice, but to the very essence of the resource. We were not promised just any wild rice; that promise could be kept by delivering sacks of grain to our members each year. We were promised the rice that grew in the waters of our people, and all the value that rice holds." For decades, Minnesota tribes have consistently and unanimously objected to the domestication of manoomin as antithetical to its cultural significance and purpose. However, this HIA focuses solely on the health impacts of regulatory changes that affect wild-grown manoomin.

The state of Minnesota and two tribes (the Fond du Lac and Grand Portage Bands of Lake Superior Chippewa) currently have a federally approved sulfate criterion of 10 mg/L in their water quality standards to protect natural wild rice stands from adverse effects of excess sulfate. This long-established criterion is based upon extensive historic biological survey and observational data compiled in the 1940s by Dr. John Moyle, a biologist in the state conservation agency that preceded today's Minnesota Department of Natural Resources (MNDNR). The U.S. Environmental Protection Agency (USEPA) approved the sulfate criterion for the state in 1973, and for both Bands (2001, 2005). Although the Bands both implement this standard through their monitoring and assessment programs, the Minnesota Pollution Control Agency (MPCA) has not been implementing it through either its monitoring and assessment program or through its water quality regulatory program; meanwhile, wild rice populations have continued to decline as a result of pollution and multiple other stressors affecting this sensitive species.

In 2011, the state legislature directed the MPCA to conduct research and propose revisions to the state's wild rice water quality rules. Recent and ongoing research by both the MPCA and the tribes, working with University of Minnesota scientists, has clearly demonstrated harmful effects of excessive sulfate loadings – depressed germination, reduced plant biomass, reduced plant reproduction, and eventual extinction – to natural wild rice waters, through the conversion of sulfate to highly toxic sulfide compounds. In November 2017, the MPCA proposed substantive changes to the state's existing sulfate criterion and other Clean Water Act protections for wild rice in ts published revisions to Minnesota water quality standards. At this time, no revisions to the state water quality standards for wild rice have been adopted or approved.

Minnesota tribes are understandably concerned that any further declines in this critical cultural and natural resource will disproportionately affect tribal members' and tribal communities' health and well-being. Over the past several decades, the tribes have had a unique relationship with the state regarding the protection of manoomin, as demonstrated through multiple rulemaking processes[8] and executive orders.[9] Fond du Lac and other tribal staff have participated in and followed closely the MPCA's research program and rulemaking approach related to the existing sulfate criteria and standards for protecting wild rice waters,[10] including the MPCA's Wild Rice Advisory Committee.

Our thorough review and interpretation of the research results for the state-led hydroponics studies, the field surveys, the mesocosm studies, and the sediment studies, in addition to our own extensive monitoring and sponsored research, lead to our conclusion that the existing federally approved sulfate criterion is well-supported by multiple lines of evidence and should be maintained and enforced. Fond du Lac's specific concerns with the MPCA's 2017 proposed rule revisions go beyond simply the changes to the sulfate criterion. They also encompass changes to the definition of wild rice waters and the applicability of numeric and narrative standards. The Fond du Lac Band has commented extensively to MPCA over the course of the state's research and rule revision processes, and those comments are part of the public record, found here:

https://www.pca.state.mn.us/sites/default/files/wq-rule4-15cc.pdf

https://www.pca.state.mn.us/sites/default/files/wq-rule4-15o.pdf

Concurrently with the state's wild rice rule revision process, Fond du Lac has also been reviewing our tribal water quality standards through a triennial review process, including our existing regulatory protections for manoomin. We are referencing our two decades of monitoring data, along with our interpretation of the latest research results, as part of our technical support documentation for maintaining the existing approved 10 mg/l sulfate criterion, and are also proposing broader ecological protections through new narrative criteria. We will be finalizing our water quality standards review and updates over the next year, and intend to incorporate the results of this Health Impact Assessment or HIA as another supporting component for our proposed

revisions. Fond du Lac is required to provide a transparent, public process for our rule revisions, just as the state is, and we believe that an HIA will help us more clearly communicate our concerns for the threats to this fundamental but diminishing cultural resource, and our rationale for strong regulatory protection.

The primary purpose of this HIA is to clearly and simply articulate the importance of manoomin to the health of the Ojibwe people. Our main objective for the HIA is to demonstrate all of the connections between manoomin and tribal people's health, because that has not been explicitly researched or publicized before and these connections to tribal health powerfully justify a protective sulfate standard. Fond du Lac has provided many arguments and evidence to state and federal agencies through public testimony, and has sponsored extensive research to confirm the protectiveness of the existing sulfate criterion, but the main purpose of the HIA is to bring to light how harmful a less protective sulfate standard would be to tribal people's health. Additionally, the many health benefits of manoomin have not been fully described, and the state's rule revision process does not adequately consider the full impact of changes to the existing wild rice standards on either human or ecosystem health. Thus, our intent with this HIA is not to propose the appropriate wild rice sulfate criterion, but to support the implementation and enforcement of broadly protective wild rice water quality standards, and make additional recommendations for sustaining manoomin in Minnesota **because of the fundamental importance of manoomin to tribal health.**

2.2.2 Treaty Rights: Forced Socio-Economic Dynamic Changes

Use of wild rice in ceremonies is also valuable to us as a family and exercising treaty rights. Wild rice is part of our prophecies.

The Fond du Lac Band retains rights to harvest manoomin not only on the Reservation established by Treaty with the United States in 1854,[11] but also over the lands that the Band aboriginally used and occupied and which were ceded to the United States by Treaties made in 1837, 1842 and 1854.[12] While the United States set aside reservations as the Chippewa's permanent homes from the lands ceded, the federal government also recognized that the small reservations were not alone sufficient to enable the Chippewa to sustain themselves. As a result, the Treaties also reserved to the Chippewa the right to hunt, fish and harvest natural resources, including manoomin, from the lands ceded by the Treaties, which extend over a large part of northeastern Minnesota. The continued existence of these usufructuary rights under these Treaties has been recognized and affirmed by the federal courts.[13] Because of these Treaties, the Band has legally protected rights and a direct interest in the protection and proper management of the natural resources on which those rights depend.

The rights to hunt, fish and gather within lands that were ceded by Native American tribes to the United States government are retained in perpetuity for the physical, cultural and spiritual well-being of tribal members, but these federally protected usufructuary rights are not fully recognized by state government, nor widely understood or respected by the general public. Yet, fundamentally, the ability to exercise those treaty rights is completely dependent upon clean water and healthy ecosystems: the very basis of sustainable resource use.[14] Treaty rights, environmental health, and tribal culture are all interconnected.

The lack of consideration for treaty rights leads to potential conflicts between policies and regulations, and the ability to continue traditional spiritual and cultural practices. When treaty rights are not honored or exercised, it limits a traditional, cultural way of life and results in a loss of traditional practices; as traditions are "erased," assimilation is imposed. Subsistence living and maintaining cultural practices are how modern tribal members preserve links to their ancestral generations, and still engage in contemporary society; for example, harvesting, finishing and marketing wild rice continues to be a source of seasonal income to many tribal members today.

Photos courtesy of the Minnesota Historical Society

2.2.3 Anishinaabe Worldview

We are one with the rice. You take my rice, you take my left arm. You take my fish, you take my right arm. There is no distinction, it's who we are.

It is our connection to the mother earth.

The Anishinaabeg recognize a profound and direct relationship between the time of the ancestors and the time of the descendents. This recognition underlies the concept of decision-making for the seventh generation, ensuring that decisions that are being made today do not have negative consequences on the quality of life of future generations. Anishinaabeg also consider all life on earth to be family or relatives, and this cultural framework affirms the interrelationship of all creation. Indigenous worldviews recognize the interdependency between humans and nature, the physical and spiritual worlds, the ancestors and future generations; all living things, animate or inanimate, are bound by a connection to everything else. This interconnectedness of all things is the first law of ecological thought.[15]

This worldview, besides recognizing mutual relationships between all things in the natural world, includes the realization that animals, plants, humans, spirits, and other natural forces strive to maintain a balance. The lessons and guidance for maintaining that balance are handed down, generation to generation, through ceremonies, storytelling, and other traditions, often tied directly to the place to which that knowledge is connected. Any disruption in indigenous land, place or culture clearly has a potentially harmful effect on indigenous health and wellness, which then may persist for generations to come.[16]

The Native American view of the world may be described as continuous 'stewardship' of the resources provided by the Creator, rather than an 'ownership' perspective that precludes others' ability to use the resource. Traditional Ojibwe oral teachings, dating back to before European contact and passed down generation by generation to modern time, is to "take only what you need and leave the rest." This ideology essentially functions as a sociocultural control for protecting a natural resource for future use; modern harvest limits and management activities are more of a political construct. The concept of reciprocity

Harmony and balance with the natural world are an integral part of the Ojibwe way of being. If we harvest too many fish in one season, there will be fewer fish to eat in the future. If we cut down too many trees, the land will become barren and regrowth will occur with brush and trees of less usefulness. If we scatter the earth with our refuse, junked cars, and abandoned appliances, the collective beauty of a place will suffer. That is the essential wisdom of the traditional way of viewing the natural world. This wisdom is really quite simple and direct: respect the plants and all the inanimates, which were the first in the creation of this earth. We need them for food and medicine and for their natural beauty. Respect our elder brothers the animals. We need them for the examples they offer on how to live, for food, and for spiritual matters. Our survival is dependent on their survival. Have respect for all things.[2]

Sacred tobacco (Asema) was given to the Anishinaabe so that we can communicate with the Spirit world. Tobacco is always offered before picking other medicines. When you offer tobacco to a plant and explain your reasons for being there, the plant will let all the plants in the area know your intentions and why you are picking them. Tobacco is used as an offering, a gift, and is an important part of Anishinaabe ceremonies.[17]

or mutuality is acted upon through the practice of making an offering (asema or tobacco) before harvesting, and then offering a feast of the first harvest for the spirits and all to celebrate. Traditional manoomin harvesting time (manoominikewin) represented much more than simply the acquisition of food; it was (and still is) a highly anticipated seasonal gathering that also included socializing and visiting. Manoomin is the first solid food given to Ojibwe infants, and is the last food offered to those who have passed, to carry them on their journey.

"The good life," or *mino-bimaadiziwin*, is the Anishinaabeg aspiration, and can only be attained through observance of community-specific spiritual and ethical codes of conduct that instruct the people how to honor their relationships and fulfill their responsibilities and obligations to all creation, ancestors, future generations, and spirit worlds.

Manoomin powerfully connects the Anishinaabeg to the spiritual world and generations to generations through traditional practices and the circle of life. Manoomin fortifies the young, heals the sick, strengthens adults, celebrates social events and other special ceremonies, and eases the loss of loved ones (Figure 1). A spiritual and practical relationship of reciprocity exists between manoomin and Anishinaabeg, where each takes care of each other.

The Anishinaabe was told to take care of the rice, and the rice will take care of you. The rice will never disappear as long as you take great care of it. And also offer your tobacco before you get into a canoe. Someone will speak to the spirit, that spirit that is in the water. This is the one that you speak to before you get into the canoe.

As we proceed to pick rice, you shall respect all things. This is what we were told. Always remember the spirit; never forget the spirit.

The Creator is the one that put this rice to be growing here on earth. That is why we offer tobacco so that we carry on these sacred teachings. To know these teachings, not only to think about it but to know it, not any ole way, not to think about them in any ole way, but to really know the teachings, this is what we were told. That is why tobacco is used before the rice is picked. This where we give our thanks for the sacredness of the rice as we give thanks. This where we give our thanks to take care of it and to make it. We are not doing enough to take care of it; we don't give enough voice to it. We do not waste any of it, we take great care of it, so that we can feed our children, so that we can feed the ones that are hungry.[18]

ADOLESCENTS & ADULTS

Manoomin is a dietary staple for adolescents and adults. It offers a rich source of protein, fiber, and manganese. It can be prepared in a variety of ways.

SIGNIFICANT LIFE EVENTS & CEREMONIES

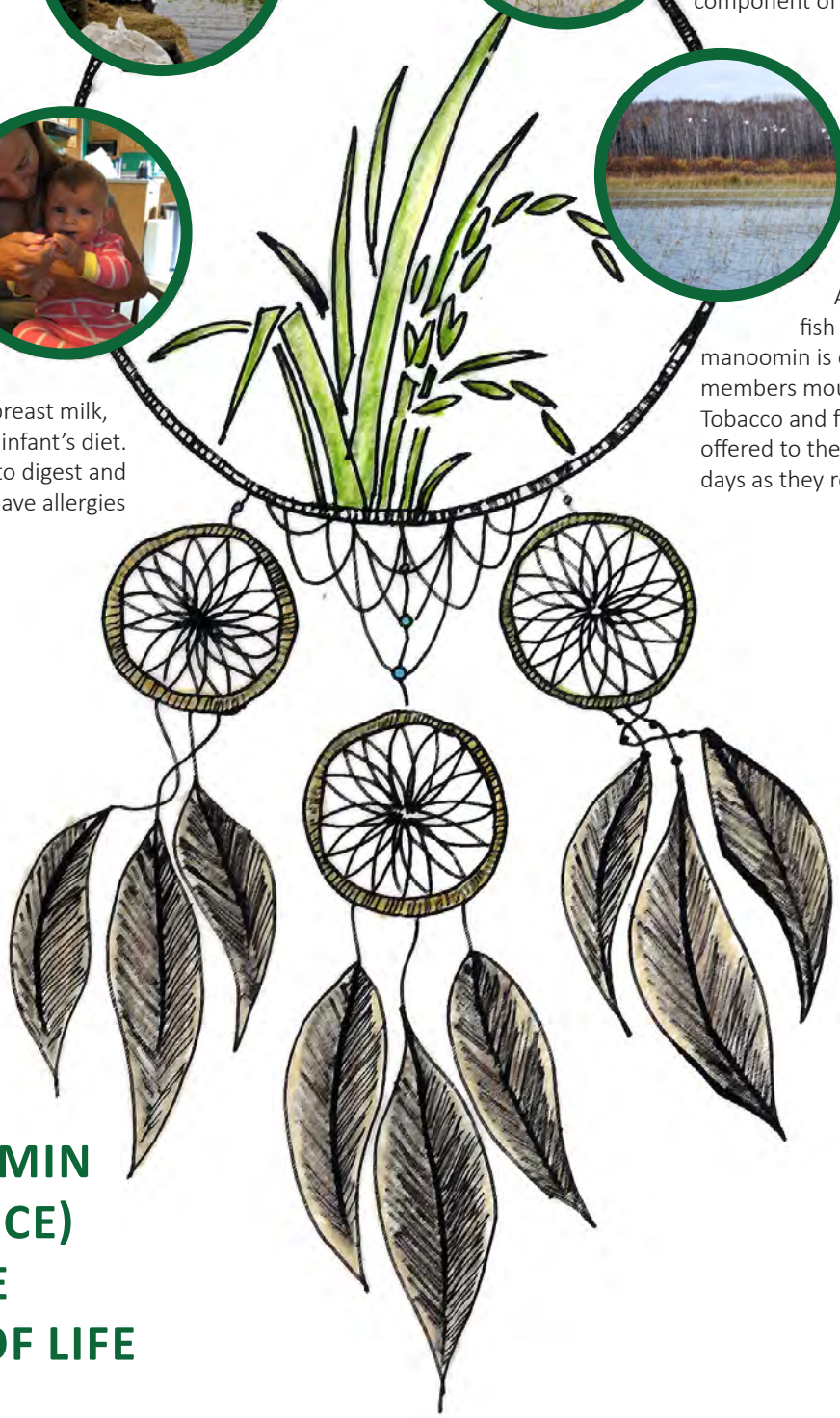
No feast is complete without manoomin. At significant life events, like weddings, manoomin is often served. Manoomin is a critical component of spiritual life.

INFANTS

Manoomin is one of the first foods, aside from breast milk, introduced into an infant's diet. It is easy for them to digest and very few children have allergies to manoomin.

DEATH

Manoomin plays a role in funeral ceremonies. Along with fish and venison, manoomin is offered to family members mourning a loss. Tobacco and food are also offered to the spirit for four days as they revisit the Earth.



MANOOMIN (WILD RICE) AND THE CIRCLE OF LIFE

Figure 1: Manoomin and the Circle of Life

2.3 HIA Approach

Ricing is a tradition that creates a community of support and keeps us out of trouble. I've been asked, "Why is everything the Anishinaabe women do hard?" We gather food in the cold and rain. This may be "hard," but it's who we are. It's an activity that grounds us and it keeps us busy. When you're done with a day of hard work, you don't have time or energy to distract yourself with drugs or other things. You stay grounded and healthy.

2.3.1 HIA Definition and Social Determinants of Health

Our health is largely influenced by other factors beyond medical care and genetics (Minnesota Department of Health, 2017). In fact, our health is determined by a wide range of factors that include individual factors, such as age and genetics; individual behaviors, such as the food we eat and how much exercise we get; living and working conditions, such as attending good schools and having safe and affordable places to live; natural and built environmental conditions, such as having clean drinking water and air to breathe; and social, economic and political factors, such as dealing with racism or inequality or gentrification (Figure 2). Health Impact Assessment (HIA) is premised on the fact that the majority of our health (approximately 60-80%) is determined by *factors that can be changed*—social, economic and political factors; natural and built environmental conditions; living and working conditions; and individual behaviors—through policies, programs and projects that consider health.

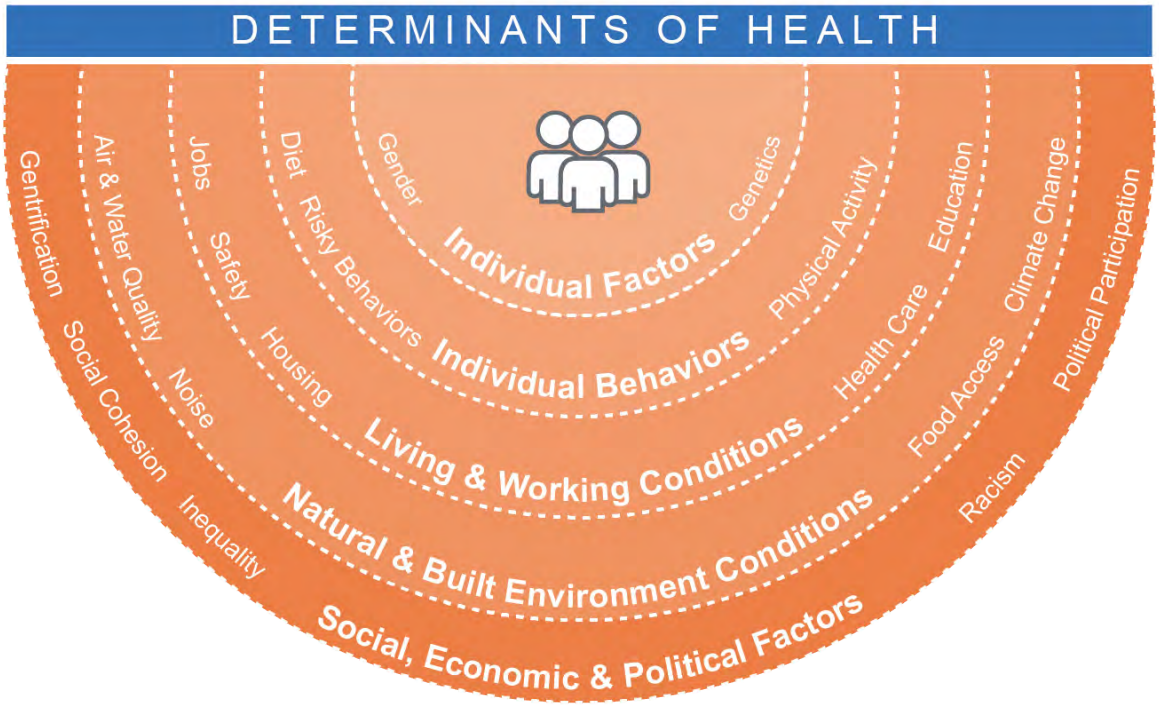


Figure 2: Determinants of Health

The technical definition of HIA by the National Research Council is the following: HIA is a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects. HIA may consider all the various factors that influence health, and especially aspects of health that are not typically considered within environmental review, such as the social determinants of health.

The social determinants of health are an important subset of all the factors that impact our health and include factors such as the nature of our social relationships; our ability to access economic opportunity; and structural racism that perpetuates health disparities (Figure 3). The social determinants of health can also include concepts that can be hard to measure and describe, but are important to well-being and mental health, including cultural connectedness and spirituality. For example, cultural connectedness and spirituality have been linked to health in indigenous populations and can be important protective factors for social behavior, suicide ideation, suicide attempts, alcohol abuse and cessation, substance abuse, and depression.

The World Health Organization recognizes that, "The social determinants of health are the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels. The social determinants of health are mostly responsible for health inequities - the unfair and avoidable differences in health status seen within and between countries." (Social Determinants of Health, 2018) Since the first contact with European settlers, American Indians have been persecuted, stripped of their land-based resources (the foundation for money), and legal power through unfair and/or unenforced treaty rights. The distribution of money, power, and resources within the United States has benefited some, while it has been detrimental to American Indian health and has created health inequities within the American Indian community. American Indian communities have some of the worst health outcomes of all segments of American society. See the Health Assessment section for more information.

To achieve health equity, where everyone has

Figure 3: Social Determinants of Health (SDOH), U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health#two

what they need to be healthy and no one is prevented from being as healthy as they can by unjust or unfair barriers, a collective narrative that's built from the social determinants of health is needed. Advancing health equity includes understanding population vulnerabilities that stem from trauma and structural inequities, while also supporting resilience that exists within communities to inform culturally-grounded solutions.[19] Before the introduction of non-natives to the United States, many American Indian communities survived and thrived on a land-based, subsistence culture, based on reciprocity. Dominant American culture forced Indigenous communities onto reservations that severely curtailed their connection to the land and almost eliminated their ability to continue their cultural and spiritual practices and subsistence lifestyle, as previous generations have done. This has created tremendous trauma within American Indian communities that plays out in a myriad of health indicators. Establishing health equity within American Indian communities means not only access to services and provisions like health care and healthy foods, it also means protecting and supporting resilient cultural and spiritual practices that connect people to their faith and identity.

Advancing health equity and building a collective narrative are central values of HIA. HIA provides a structured process that aims to protect and promote health and reduce health inequities during a decision-making process. The HIA process can help transform how decisions are made, who has an active voice in the decision, and how those decisions impact the health of those most vulnerable. An HIA uses analytic methods and stakeholder input to systematically determine the potential population health effects of a proposed policy and provides recommendations to decision-makers to provide equitable distribution of health benefits (National Research Council, 2011) (Society of Practitioners of Health Impact Assessment, 2018).

HIA is distinguished from other processes used to inform decisions by a methodical, six-step process that considers a range of potential impacts of a proposal, emphasizing impacts on the social determinants of health, health status and health equity. (Figure 4)

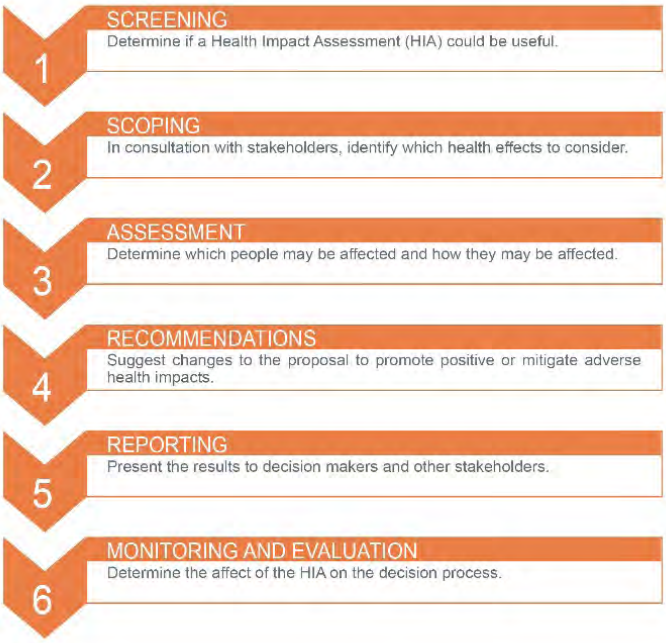


Figure 4: HIA six-step process. Minnesota Department of Health, 2016.

The first step, Screening, determines whether or not an HIA would be of value and if HIA is an appropriate tool for assessing the impacts of the proposed policy or program. Key criteria are screened in context of the impacted community and the proposed decision:

1. Is the proposed decision likely to impact human health?
2. Can the HIA add value to the decision-making process?
3. Can the HIA inform the decision?

Examining these screening criteria provides a starting point for building capacity to address salient health issues of the impacted community. In the second step, Scoping, health implications of the proposed decision,

both positive and negative, are explicitly identified. Those who are likely to be impacted the most are instrumental in identifying the potential health impacts and prioritizing the health impacts to be evaluated in the HIA. Analysis methods, based on resources and timeframe, are also determined.

The next step, Assessment, provides a profile of existing health conditions of the impacted community and analyzes the potential health impacts. The Assessment encompasses a comprehensive approach to health, reviewing factors and conditions that reinforce vulnerability to negative health outcomes, including the social determinants of health, in addition to health conditions like heart disease or diabetes. The Assessment builds the foundation for the Recommendations phase, which develops recommendations to prevent negative health impacts or promote positive health impacts based on the evidence described in the Assessment. Recommendations are articulated in a transparent, evidence-based report that helps build mutual understanding of the facts, data and associated health implications. The report provides an important role in legitimizing and elevating community voices and can help inform inclusive strategies to protect public health. After the report is published and shared with decision-makers and stakeholders, the final phase, Monitoring and Evaluation, occurs. Monitoring and Evaluation includes assessing the HIA process, the impacts of the HIA on the proposed decision, and the impacts of the implemented decision on health outcomes.[20]

2.3.2 HIA Process and Stakeholder Engagement

This HIA sprang from a meeting in late 2016, when the Fond du Lac Band of Lake Superior Chippewa Resource Management Division and the Minnesota Department of Health (MDH) Climate & Health Program met together to build relationships and discuss possible projects. After sharing information, Fond du Lac staff suggested that an HIA might be an opportunity to work collaboratively. They noted that an HIA could be an appropriate tool for evaluating and communicating potential health effects of an upcoming decision on changes to the wild rice water quality rules. Fond du Lac staff described the challenges that they have had in documenting and publicizing the impacts to community health, social cohesion, access to healthy food, equity, and other important issues related to the degradation of wild rice. Fond du Lac pointed out that the State of Minnesota is nearing a major regulatory decision on water quality standards revisions that tribes believe should be more holistically considerate of the full gradient of social and environmental impacts, and not just economic cost and regulatory considerations. After further conversations following the initial meeting, Fond du Lac and MDH agreed to move ahead with an HIA because an HIA could more fully evaluate the influence of wild rice on the health and well-being of the tribes, and information from the HIA could be useful in influencing the regulatory decision to protect tribal health.

Fond du Lac has long been interested in exploring connections between environmental exposures/environmental quality and human health and has had, for the most part, a fruitful relationship with MDH. Fond du Lac has worked with MDH since 2000 to establish and update reservation-specific, tribally-sensitive fish consumption guidance, and has collaborated with MDH and the University of Minnesota on a risk-benefits analysis exploring chronic health issues as they relate to a westernized diet replacing a more traditional subsistence diet. Fond du Lac's clinic and environmental staff collaborated with MDH on a human biomonitoring project examining health effects and exposures to Great Lakes environmental contaminants. This interest is grounded in the knowledge that disconnection from traditional lifeways is a major contributing factor in tribal health disparities, including diabetes, cardiac and respiratory diseases, cancer and addictions.

Early in the HIA process, Fond du Lac and MDH articulated their roles and responsibilities to help ensure the successful completion of the HIA. It was decided that Fond du Lac would lead the HIA; determine, invite and engage stakeholders within the HIA process; organize Steering Committee and public meetings; make decisions regarding scope, data analysis, and recommendations within the HIA; communicate the HIA; and own the final HIA document and supporting materials. MDH would provide technical assistance on HIA process and methods, including aiding Fond du Lac through the six HIA steps (i.e., screening, scoping, assessment, recommendations, reporting, and evaluation); assist with agenda development and meeting facilitation; help obtain, analyze and synthesize health data as appropriate to the HIA; and assist with report writing as directed by Fond du Lac. From that understanding, an HIA coordinating team (the core team) was formed consisting of FDL and MDH staff.

Fond du Lac recruited a diversity of people to the HIA Steering Committee to help facilitate the process and provide knowledge and expertise to the HIA. In addition to health experts and community members, policymakers with influence over wild rice policies were invited to participate on the HIA Steering Committee, including representatives from MPCA, DNR and the US EPA. A list of the Steering Committee members can be found at the beginning of this report. The Steering Committee met five times. Meetings took place on August 1, 2017; September 2, 2017; December 5, 2017; June 19, 2018; and August 27, 2018.

Fond du Lac kicked off the HIA process with a public meeting on June 19, 2017 to explore the connections between manoomin, environmental quality, and tribal health. In addition to presentations and lively conversation, attendees provided input on the HIA through an informal survey. Additional Fond du Lac community feedback on the importance of manoomin to health was obtained through a community health fair survey.

Research scientists from the US EPA's Midcontinent Ecology Laboratory in Duluth stepped forward to assume responsibility for analyzing the health fair surveys and the community meeting surveys. The researchers performed content analysis on the qualitative data to identify themes. For more information on research methods and a detailed description of the results, see Appendix C. The content analysis of the health fair surveys uncovered several strong themes: 1) **identity**-manoomin is central to Anishinaabe identity and preservation of culture; 2) **social relations**-manoomin contributes to bonding, traditions and strengthening family and community connections; 3) **health**-manoomin is a healthy, traditional food source and medicine; 4) **environment**-manoomin provides important connections to the earth and needs clean water to survive; 5) **enjoyment**-manoomin tastes good; and 6) **activity**-harvesting and eating manoomin are activities that are important to the Anishinaabe. Two additional themes were derived from an analysis of the community meeting surveys: 1) **management**-survey respondents expressed concerns regarding the protection and management of manoomin; and 2) **supply**-survey participants stated that having a good supply of manoomin meant food security to them.

Draft results from the surveys were presented to the HIA Steering Committee. Steering Committee members considered draft pathway diagrams developed by the MDH and Fond du Lac core team and the survey results to help determine areas for the assessment. After full discussion and sharing of ideas, the Steering Committee engaged in a prioritization exercise to identify the top stressors: climate change, changing land use and hydrologic alteration, historical loss affecting sustainability of populations, and forced socioeconomic dynamics related to extractive industries; and top impacts: culture and cultural identity, social connectedness and spirituality, treaty infringement, physical health, nutrition, and active harvesting to be more fully explored in the HIA.

A faculty member of the University of Minnesota's School of Public health recruited

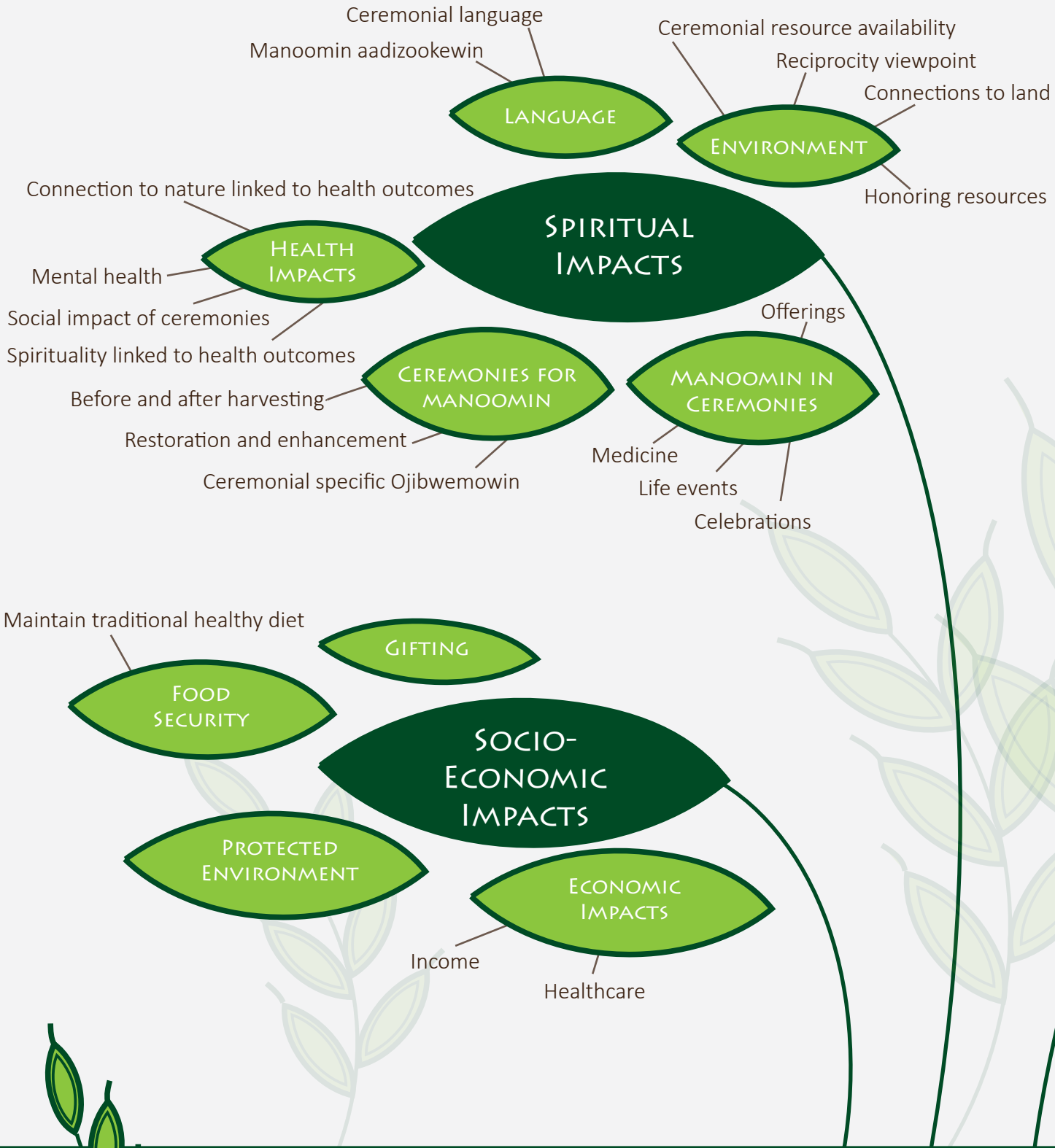
a team of graduate students to begin researching the prioritized areas. The students conducted literature searches of relevant studies and publications to inform various sections of the assessment. Over the course of their spring 2018 semester, they completed their research and reported back to the core team and Steering Committee with their results in June 2018. Their research provided a strong foundation for the health assessment. In addition, the Fond du Lac Reservation Business Committee provided funding to contract with Earth Economics to conduct an economic analysis of the benefits of manoomin harvesting to the tribal communities' and the state's economies. These results are elucidated in the next section of the report.

After review of the students' work and additional discussions with the Steering Committee, an improved pathway was developed to better describe the connections between the health of the Anishinaabe people and the health of manoomin. Originally the draft pathway diagrams were linear, attempting to connect manoomin with a range of socio-, cultural, spiritual, economic and health impacts, but it became clear that the impacts of manoomin on the health of the Anishinaabeg people are myriad, interwoven, and complex. A linear pathway diagram could not do justice to the reality of the reliance on and the importance of manoomin to all facets of Ojibwe life. The diagram that emerged better articulates the interconnections between manoomin and the health of tribal people (see Figure 5 on pages 24-25).

Though the latest diagram does not capture all the intricacies and nuances of the interconnectedness between manoomin and health, it does present some of the main associations and key impacts of manoomin on the Anishinaabeg that we identified from surveys, Steering Committee members' comments, and research. Several areas of impact are repeated within the main areas of impact. This is because many of the impacts interrelate. Thus, an impact like food security can be found within socio-economic impacts as well as physical sustenance impacts. Five main lifeways were identified that are impacted by manoomin: **traditional knowledge impacts**, including the Ojibwe migration story and traditional ecological knowledge; **cultural impacts,** including manoominikewin (manoomin harvesting), social justice, language, treaty rights, and food; **spirituality impacts**, including ceremonies *for* manoomin, connections to the environment, manoomin *in* ceremonies, health impacts, and language; **socio-economic impacts**, including food security, economic impacts, gifting, and protected environment; and **physical sustenance impacts,** including food security, nutritional health, medicine, healthy weight maintenance, and traditional diet.

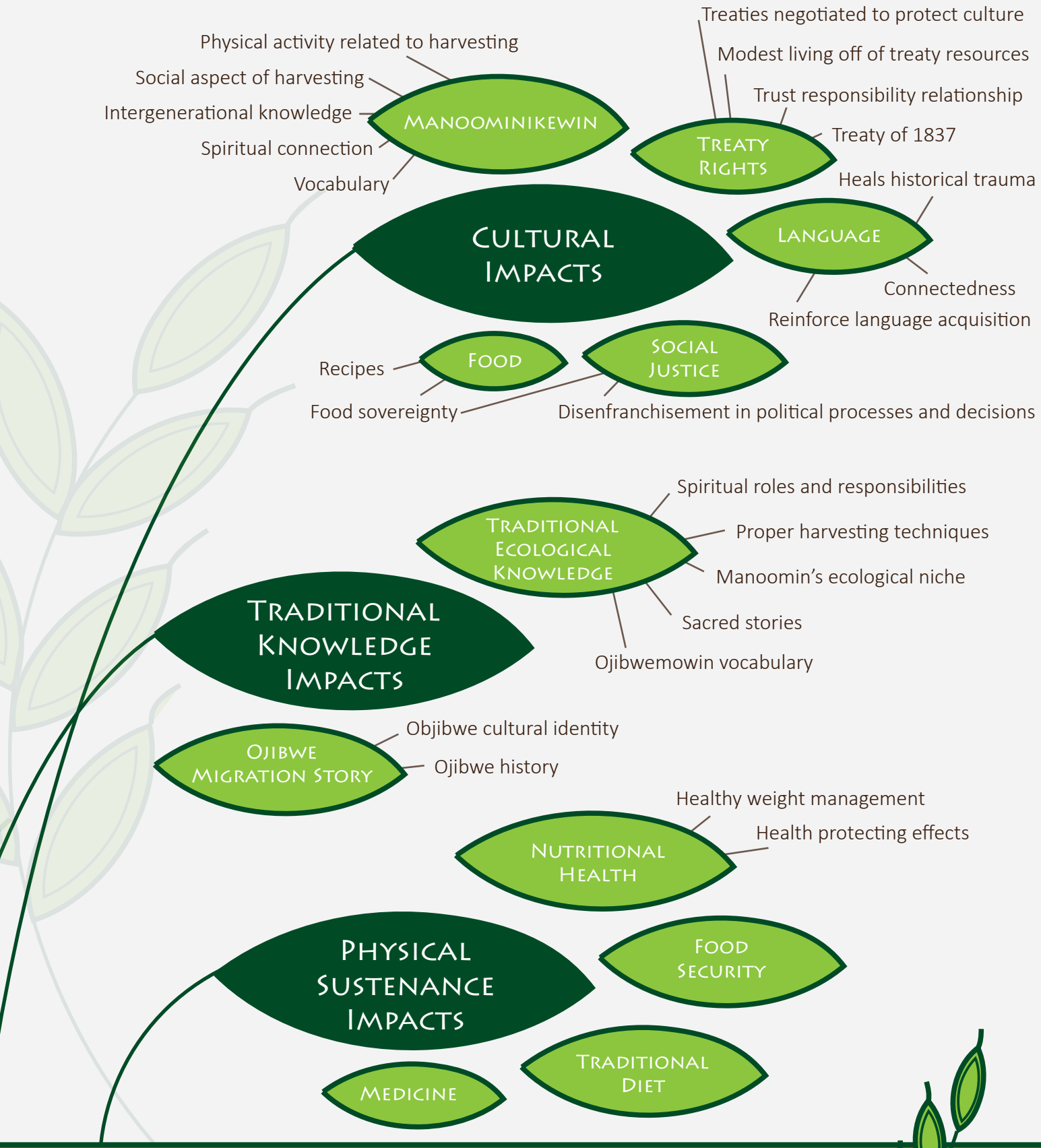
Ultimately, the impacts assessed in the HIA grew organically from the interplay between sharing additional research findings and Steering Committee discussions. Most of the impacts articulated in the final pathway diagram are analyzed and described in the next section. Finally, the recommendations were developed utilizing ongoing feedback derived from the Steering Committee meetings and emails to the Steering Committee members.

Figure 5: Pathway diagram illustrating interconnectedness of manoomin and tribal health. →



Manoomin

Pathway to Mino-bimaadiziwin



(Wild Rice)

(The Good Life)

3. Health Assessment

Manoomin is medicine, a way of life, tradition and very important food source.

Although American Indians experienced a history of discrimination, genocide, and racism that continues today in various forms, they remain a powerful and resilient people. The following section describes the current conditions of Minnesota Indian health and well-being and manoomin, and the impacts that could happen with a less protective sulfate standard and continuing environmental impacts.

Within the Anishinaabe worldview, the health of manoomin and the health of the people are inseparable, as one depends on the other and vice versa, so this section purposefully interweaves the health of Minnesota American Indians with the health of manoomin and the stressors that influence them both. More specifically, the section details baseline information on Minnesota American Indian health status, describes the effects of a reduction in manoomin on physical, nutritional, cultural, spiritual, and mental health, as well as the effects on food security, food sovereignty and economic health, and articulates the additional stressors that affect the health and sustainabilty of manoomin, including climate change.

3.1 Minnesota American Indian Demographics, Social Determinants of Health, and Health Status

It's part of our diet, every day, it is who we are. We used to not have to pay for our food, and we were healthy. We had enough meat and rice to survive. Now we have to add processed food and are getting sick. I have diabetes and it's probably linked to that switch. I was healthy when I only ate traditional food.

3.1.1 Population statistics

The Fond du Lac tribe has 4,127 members enrolled as of 2010.[21] The total American Indian population in the state of Minnesota is approximately 58,000, out of a total population of nearly 4.5 million. While that only represents less than 2% of the statewide population, certain counties or regions have a higher proportion of self-identifying American Indians. Population trends for American Indians in the state of Minnesota have been erratic over time, but suggest slower growth than other ethnic groups. The population is aging, with the under 15 age group expecting to decline, and over half of the population expected to be in the over 65 year age group.[22]

3.1.2 Health statistics

Describing the baseline health statistics for Tribal populations in Minnesota is challenging because of the lack of specific data. In most cases, data for American Indians is only available at the state or county level. Because most tribal members in Minnesota would be or already have been, in the case of the Dakota tribes, affected by a change in the health and sustainability of wild rice, generally all Tribes were considered within the data. When available, data from specific tribes were used and noted.

Life expectancy and birth-related statistics demonstrate a few of the health inequities faced by Minnesota Indigenous communities.

In Minnesota the average life expectancy is 81 years, ranking 4th in the United States.[23] However, life expectancy by race/ethnicity varies significantly in Minnesota. The highest life expectancy at birth by race/ethnicity is 87 years for the Latino population in Minnesota.[24] The lowest life expectancy at birth is 70.2 years for Native Americans. The next lowest life expectancy at birth in Minnesota is 79.7 years for African Americans.[24] Native Americans in Minnesota have the lowest life expectancy, 10 years less than the average life expectancy.

Minnesota American Indian women lack basic care and necessities for supporting a healthy pregnancy and babies. In 2010, 51% of American Indian mothers who gave birth did not receive adequate prenatal care.[25] In 2009, American Indian babies had the second highest infant mortality of all race/ethnicities in Minnesota of 7.5 deaths per 1,000 (the average in 2009 was 4.5 infant deaths per 1,000 live births).[25] In 2012-2014, 33% of Native American pregnant women experienced food insecurity 12 months before their baby was born.[26]

Similar to the United States population in general, the 10 leading causes of mortality for the American Indian population in the United States are heart disease, cancer, injuries, diabetes, chronic liver disease, chronic respiratory disease, stroke, suicide, nephritis, and influenza/pneumonia.[27] Most of these illnesses are associated with obesity, alcohol abuse, and smoking.[27]

3.1.3 Social Determinants of Health

Lower education and graduation rates, poverty rates, lack of health insurance, homelessness, and violence and substance abuse further contribute to Minnesota Tribal health inequities. Between 2010 and 2015 American Indians had the lowest or second lowest attainment rate of associate degree (or higher) of all races and ethnicities in Minnesota.[28] The Minnesota Office of Higher Education recognizes that median income increases with educational attainment. There's a $5,000 a year difference between what high school graduates make and what people with some college or an associate degree make.[28] There is a $20,000 a year difference between what high school graduates make and what people with a bachelor's degree make.[28]

Within the United States, Minnesota's American Indian on-time high school graduation rate ranks 45th.[29] Within Minnesota, American Indian students are less likely to graduate from high school than any other student of any other race/ethnicity.[29] Many researchers attribute most if not all of the struggles that American Indian students face in school systems to pressures of navigating historical trauma.[29] Lower graduation rates affect people's ability to obtain well-paying jobs that can lift families out of poverty and lower income brackets.

According to the Ojibwe State Health Improvement Plan (SHIP) survey of 2011, 25% of people in the Fond du Lac tribe live on an annual household income of under $10,000.[30] According to the U.S. Census, American Indians across Minnesota continue to see a median household income of about half that of the median household income for the general Minnesota population.[31] American Indian adolescents in Minnesota experience poverty at a rate of 32.5%.[32]

Access to healthcare and health insurance is another challenge for Native Americans. American Indians in Minnesota lack access to

It is very important for our community because the gathering of wild rice is such a communal endeavor for families and when they gather there is the camaraderie, the visiting, and the family grows together in doing something so special for the survival of our families!

health insurance, with overall uninsured rates of about 23% in 2015.[33] Many seek care from the Indian Health Service clinics, including the Min-no-aya-win Health Center in Cloquet, Minnesota.[34]

High poverty rates can lead to housing insecurity and homelessness. Conservative estimates of homelessness on northern Minnesota's American Indian reservations, including the Fond du Lac Reservation, found American Indians make up 12% of Minnesota's homeless adult and 20% of Minnesota's homeless youth populations, despite comprising 1% of the general population.[35] These measures do not include individuals experiencing "near-homelessness," where they are staying in the home of a friend or relative temporarily while they do not have housing for themselves and their own immediate family.

Native Americans experience poorer health outcomes, including double the rate of heart disease compared to other populations, higher rates of obesity, the highest rates of high blood pressure, cholesterol, and Type II diabetes of any racial group in the country.

Serious health conditions (chronic diseases, serious mental health conditions, and/or substance use disorders) affect 61% of Minnesota's American Indian tribal members on reservations experiencing homelessness and near-homelessness.[35] This same population has a medical insurance rate of only 55% (compared with 78% insurance rate for Minnesota's general homeless population). Approximately 18% of American Indians experiencing homelessness and near-homelessness on northern Minnesota's American Indian reservations have no source of medical care.[35]

American Indian tribal members experiencing homelessness on northern Minnesota's reservations are also more likely to experience barriers related to transportation (limiting employment), experience incarceration and overcrowding, and have less education (with 60% having less than a high school diploma or GED).[35]

Among those experiencing homelessness and near-homelessness on reservations in northern Minnesota, 71% were actively looking for housing. Surveyed Minnesota American Indians reported that they are able to pay a median value of $300 per month for housing and utilities. However, the average respondent in this survey had a monthly income of only $400, making their housing costs 75% of their monthly income (unaffordable according to HUD's standards).[35]

Violence and substance abuse also contribute to the health inequities that American Indians face. In a survey of American Indian youth in Minnesota, 1 in 3 12th grade students reported alcohol use by a family member, and 1 in 4 12th grade students reported drug use by a family member caused repeated problems in their home.[32] Individuals experiencing homelessness or near-homelessness on Minnesota's reservations reported a 30% rate of alcohol use in the last 30 days and 13% reported using prescription drugs not prescribed to them.[35] Among American Indians leaving their housing on reservations in Minnesota, 14% of men and 11% of women cited violence in the neighborhood as a contributing factor.[35] Minnesota's American Indian population living on reservations such as the Fond du Lac Reservation struggle with access to culturally competent treatment facilities when they do struggle with drug and alcohol use disorders.[36]

3.1.4 Health Status: Obesity and Chronic Disease

As a 67-year-old Fond du Lac enrollee and resident, and type 2 diabetic for the past 24 years, wild rice is a very important food source that is nutritious (lower glycemic) and healthy for me and my family.

Native Americans experience poorer health outcomes, including double the rate of heart disease compared to other populations, higher rates of obesity, the highest rates of high blood pressure, cholesterol, and Type II diabetes of any racial group in the country, and are twice as likely to die from diabetes. Diabetes rates are rising among Native American children more rapidly than any other group. Additionally, food insecurity further increases the risk of heart disease, obesity, and diabetes.

Therapeutic lifestyle changes, including increased physical activity designed to achieve weight loss, are essential for managing diabetes and its comorbidities.

Obesity is the fastest growing epidemic in America. It impacts just about every other chronic medical illness, and drives 75% of the medical costs in the nation. The detrimental health consequences of obesity include stroke, coronary heart disease, diabetes, dyslipidemia, hypertension, severe pancreatitis, osteoarthritis, gynecologic abnormalities, gall bladder disease, non-alcoholic fatty liver disease, and pulmonary disease. Obesity affects every organ system and increases the risk of mortality, decreases quality of life, complicates pregnancy, decreases the quality of sleep, decreases energy levels, negatively impacts activities of daily living, decreases endurance, and negatively impacts mental health.

The prevalence of obesity was 39.8% and affected about 93.3 million of US adults in 2015 – 2016. However, the American Indians/Alaskan Natives (AI/AN) prevalence of obesity far exceeds the national prevalence by more than double, as 81% are obese. Overweight and obesity are driving extremely high rates of chronic disease in American Indians and Alaska Natives, including diabetes, cardiovascular disease, stroke, and some types of cancer.

In 2017, 24% and 59% of patients who presented to one of the Fond du Lac medical clinics at the Center for American Indian Resources or Min No Aya Win Human Services Center, respectively, had a recorded body mass index (BMI) of overweight or obese.

Type 2 diabetes, the most common form of diabetes, is a complex disease in which the body becomes resistant to insulin and, eventually, is no longer able to produce sufficient amounts of insulin. In turn, this leads to an increase in blood sugar levels which damages arteries, leading to high blood pressure and the build-up of plaque. Moreover, diabetes increases cholesterol, further contributing to plaque build-up. Combined diabetes, increased cholesterol, and plaque build-up often lead to blockages causing stroke and heart attack.

The connection between diabetes and cardiovascular disease (CVD) cannot be overstated. Diabetes is the single greatest risk factor for developing CVD. According to the Centers for Disease Control and Prevention (CDC), AI/AN people have the highest rates of diagnosed diabetes of any racial/ethnic group in the United States. Correspondingly, the CDC also reports CVD as the leading cause of death among AI/AN people. Compared to individuals

without diabetes, those with diabetes have a 2 to 4 fold increased risk of dying from CVD.

Despite focused clinical efforts for nearly 20 years, FDL Human Services diabetes registry numbers continue to increase. Of the 686 patients with diabetes on the 2017 FDL Human Services Diabetes Audit Report, 55% were female and 45% were male. Amongst those with diabetes, 22% are overweight (BMI 25.0 – 29.9), 71% are obese (BMI 30.0 or higher), and among those who are obese, 23% are severely obese (BMI 40.0 or above). When compared to the aggregate 2017 IHS Bemidji Area Diabetes Audit, 82% of FDL diabetes patients were diagnosed within the last 10-years, versus 43% for the overall Bemidji Area.

The incidence of one or more comorbidities for FDL diabetic patients occurs at a rate of ***95%***: hypertension co-occurs in 63% of patients, 38% have co-occurring depression, 38% have co-occurring cardiovascular disease, 31% have co-occurring chronic kidney disease, and 23% of patients are severely obese. Further complicating determinants of health for those with diabetes, an unprecedented 68% of FDL diabetes patients use non-ceremonial tobacco.

Amongst those with diabetes, diabetes medications were prescribed alone, or in combination as treatment for 89% of patients; while only 21% of patients rely on diet and exercise alone as treatment. Furthermore, of those 89% prescribed diabetic medication, nearly 40% were prescribed 2 or more diabetes medications.

Obesity and overweight, two increasingly prevalent risk factors among American Indian people with diabetes, increase insulin resistance, and raise blood glucose levels. In turn, they exacerbate diabetes complications and make diabetes management more complex. Therapeutic lifestyle changes, including increased physical activity designed to achieve weight loss, are essential for managing diabetes and its comorbidities.

3.2 Integration of Health Status with Co-Occurring Stressors and Potential Health Outcomes

I can give you at least eight generations of family oral history of us harvesting wild rice. This is the first food we give to our babies. We have lifelong connections to our sacred food.

3.2.1 Physical Activity

Regular physical activity is critical to living a healthy lifestyle and long life. The Centers for Disease Control and Prevention (CDC) recommend adults complete at least 150 minutes of moderate-intensity aerobic activity every week and weight training activities on two or more days per week. Engaging in physical activity is important to manage weight, strengthen muscles, and reduce the risks of cardiovascular disease, type 2 diabetes, and some types of cancers. Studies show that those who are physically active for at least 150 minutes a week are at lower risk for dying early.[37]

Physical activity is important for achieving glycemic control goals, and it is a core component of diabetes self-management. Physical activity improves strength and endurance, improves insulin action, lowers blood glucose levels, improves body mass index, and reduces depression. *Any* increase in physical activity is beneficial for diabetes patients. Physical activity does not have to be limited to structured aerobic or resistance exercise; it can include activities such as walking, gardening, dancing, ricing, and any movement of the body that uses energy.

According to the Fond du Lac Statewide Health Improvement Plan (SHIP) survey,[27] 51% were obese, 25% exercised 3 days a week, 46% reported it was often or sometimes true they worried food would run out before they had money to buy more, approximately 22% lived 10 or more miles from a grocery store with a good selection of fruits and vegetables, 60% ate fast food 1-3 times in the previous week, 22% drank regular soda at least 4 times in 7 days, 37% consumed at least one alcoholic beverage in the previous month, 12% reported binge drinking, and 63% of those who worked, reported their jobs to be mostly sitting or standing. In the 2017 Fond du Lac Needs Assessment, only 31% of respondents reported very good or excellent physical health and only 24% reported doing moderate physical activity every week.

The impact of the Western lifestyle on traditional hunting and gathering populations has been studied over time, specifically among the Inuit community in northern Canada.[38] In a 20-year fitness study from 1970 to 1990, researchers tracked fitness trends using measures including body mass, lung volume, and aerobic power.[39] They concluded that fitness of the community had deteriorated over time, as behaviors became more sedentary and suggested that health professionals develop culturally appropriate methods to promote an active lifestyle.

Other scholars agree with this sentiment. In a 2015 commentary published by the Institute of Medicine, the chair of the American Indian Public Health program at North Dakota State University said that the shift from traditional hunting and gathering to a sedentary lifestyle and dependence on federal government food has had a direct impact on the health of Native American people.[40] The commentary also stated that Native American communities disproportionally lack safe places to exercise, and among Midwestern communities canoeing and wild rice gathering offer opportunities to engage in physical activity to promote health and prevent obesity. The physical activity associated with traditional food gathering, combined with the high nutritional value may offer benefits to decreasing risks of chronic disease.[41]

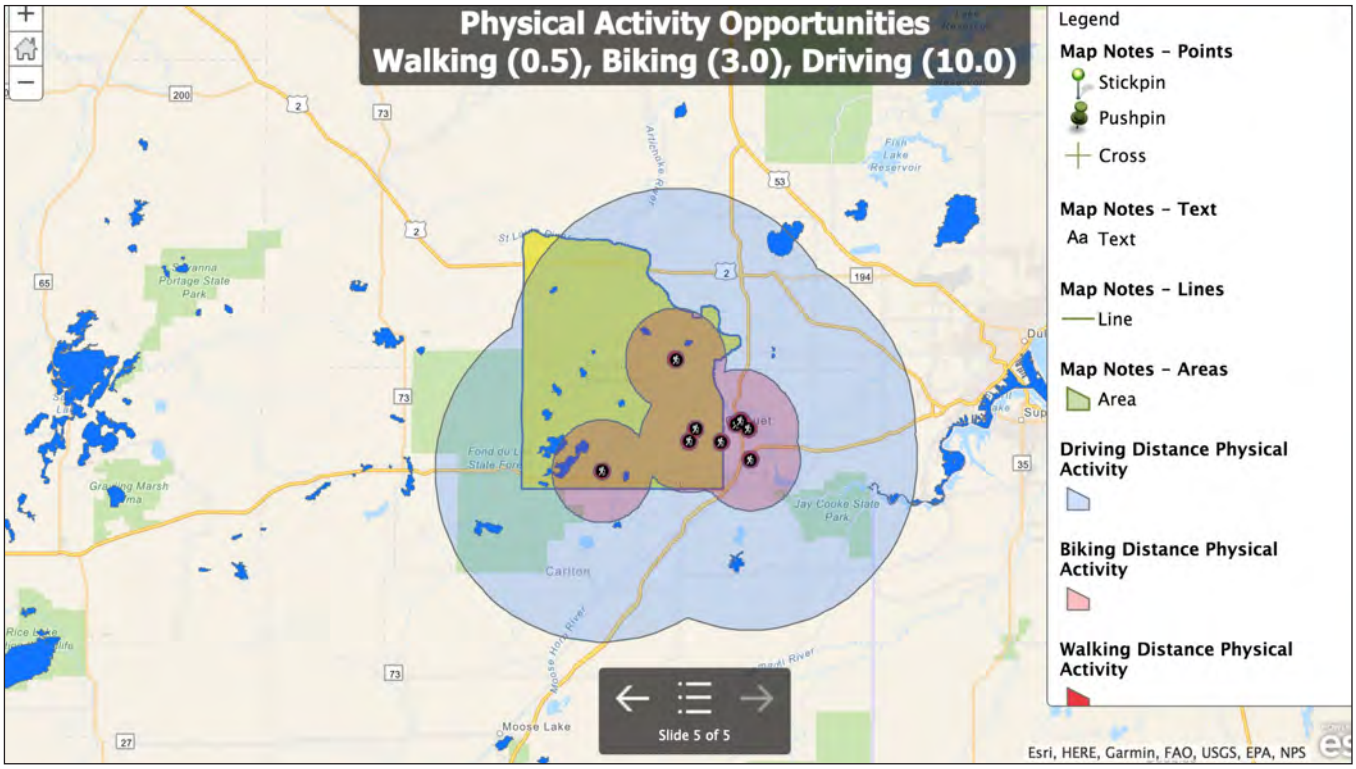


Figure 6: Physical activity opportunities near the Fond du Lac Reservation.

Wild rice health benefits: Harvesting as Healthy Activity (Exercise)

As mentioned above, the profound health benefits of regular physical exercise and maintaining a healthy body weight are well established. Harvesting wild rice offers opportunity for physical activity. However, at the time of this HIA, there is little quantitative data available about the duration, intensity and caloric output of traditional rice harvesting and ricing-related activities.

Efforts to understand the scope and impact of ricing-related physical activity should include the physical effort taken to travel to and from ricing beds (canoeing distances on rivers and lakes, hiking portages) as well as the actual rice harvesting itself. Harvesting includes the jobs of poling or knocking in the canoe. Harvesting can continue for several hours and on multiple days. In addition to the harvesting work, the exertion related to loading, bagging, drying and transporting rice should be captured also. Special events involving wild rice, such as ceremonies and pow wows, may offer additional opportunities for physical exercise.

Specific data for Fond du Lac Band member harvesting activities has not been gathered, but could be compared to published information on caloric expenditures. Harvesting wild rice by "knocking rice off the stalks" is reported to burn 156 calories per hour for a 150 lb. person.[42] Comparably, walking at a rate of 3 mph also requires approximately 156 calories/hour; walking and 'knocking' share similar exertional profiles. Estimates for the caloric outlay for the poler in the canoe were not found, but paddling a canoe with light effort, 2.0–3.9 mph, can burn an estimated 136 calories per hour for a 150 lb. person. This likely underestimates the caloric expenditure of poling, which involves a single person moving a canoe, rice, and harvesting partner through thick vegetation. In contrast, portaging the canoe requires an estimated 408 calories per hour. For those rice harvesters who also parch and winnow their own rice, there would be additional physical effort involved in those multiple steps. Ricing, as a means of physical activity, can be an important component of a healthy lifestyle, helping to curtail obesity and related chronic diseases, especially in Indigenous populations.

3.2.2 Nutrition

Very special gift. Healthier for the family eating wild rice instead of white rice. Important for diabetes control and weight control. Nutritious food for everyone.

Hand-harvested manoomin is a traditional staple food that provides irreplaceable cultural and nutritional benefits. Nearly 58,000 Native Americans in Minnesota consume between 155,000 and 563,000 pounds of manoomin each year; that's an average of more than 6 pounds per person (Appendix A, Earth Economics Report). However, survey results from 2018 showed that Native American respondents still wish to almost double their consumption of manoomin.

The word *nutrition* is defined in the English Oxford Living Dictionaries as *the process of providing or obtaining the food necessary for health and growth.*[43] Wild rice has been referred to as a "super food" because it offers a healthy composition of protein, minerals, vitamins, healthy carbohydrates and favorable fat content—elements that contribute to human health and growth. In the past 5-10 years, additional studies have demonstrated deeper understanding of wild rice's potential human health benefits, including the areas of cardiovascular health, weight and blood sugar control, and colon cancer risk reduction.

Wild rice is distinct from white or brown rice. Wild rice belongs to the grass family, Poeaccae, and is classified as a cereal. Grasses that grow and provide an edible seed are called cereals. Globally, cereals provide a major source of carbohydrates for humans. Examples of familiar cereals include oats, wheat, rice and corn.

Wild rice's nutritional composition is comparable or even superior to other important cereals, supporting wild rice's role as a dietary staple. Wild rice is recognized as a whole grain. The U.S. Food and Drug Administration (FDA) defines whole grains as consisting of the intact, ground, cracked, or flaked fruit of the grains whose principal components, the starchy endosperm, germ, and bran, are present in the same relative proportions as they exist in the intact grain.[44]

Macronutrient content of wild rice species (*Zizania* spp.) have been presented and published in numerous papers[37,45,46] and can be contrasted with other rice grains. Macronutrient composition of wild rice is found in Table 3 along with comparative values for white and brown rice.

As the table indicates, wild rice contains higher content of protein, fat and dietary fiber and a slightly lower carbohydrate content than white and brown rice. Overall amounts of fat (also called lipids) in wild rice are low--about 1% of the total, showing that wild rice is a low-fat food. The caloric density, or energy content, is

Nutrient	Wild Rice, raw	White Rice, Long grain, enriched raw	Brown Rice, Long Grain, raw
Protein (g/100 g)	14.7	7.13	7.94
Lipid (fat) (g/100 g)	1.1	0.66	2.92
Dietary fiber (g/100 g)	6.2	1.30	3.5
Carbohydrate (g/100 g)	75	79.95	77.24
Moisture (g/100 g)	7.76	11.62	10.37
Energy (kcal/100 g)	357	365	370

Table 3: Nutritional Composition of North American Wild Rice, White Rice, and Brown Rice

similar for wild, white and brown rice. Wild rice is high in dietary fiber, which has a variety of health benefits.

Despite being a low fat food, the kinds of fats found in rice are felt to have protective properties and reduce cardiovascular disease—omega-3 fatty acids, for example. A 45-gram (¼ cup uncooked, ¾ cup cooked) serving of wild rice contains 0.082-0.156 grams of omega-3 fatty acid. The same serving of brown rice offers 0.02 grams of omega-3 fatty acid. Wild rice contains approximately 4-8 times higher omega-3 levels than brown rice. Fatty acids that are important for health can be found in wild rice, with linolenic and linoleic acids as examples.[39]

Wild rice is also an excellent source of the B vitamins—thiamin (B1), riboflavin (B2) and niacin (B3). Vitamins are defined as compounds that are essential for normal human function and growth and must be obtained through dietary intake because they cannot be synthesized by the human body. Table 4 compares B vitamin content of wild rice to other cereals, demonstrating wild rice to be equal or higher in B-vitamin content.

In addition to providing a high quality protein source, wild rice is also a gluten-free food. Gluten is a protein fraction found in wheat, barley and rye that can cause inflammation in susceptible individuals.[38] These individuals have an autoimmune disorder called celiac disease, also known as celiac sprue. Other individuals, as many as 6% of the American population, may test negative for celiac disease but still have gluten intolerance (nonceliac gluten sensitivity). Treatment for both is a lifelong adherence to a strict gluten-free diet.

Without gluten-free diet adherence, people with celiac disease can suffer from malabsorption of nutrients and subsequent complications. Untreated celiac disease can lead to osteoporosis (brittle bones) and fractures from calcium deficiency, profound anemia (low red blood cells and low oxygen in blood) from iron deficiency and other very serious health complications. Celiac disease can occur at any stage of life, from infants to elders. It is fairly common; approximately 1 in 141 Americans have the disease.[47]

For celiac patients, adherence to a gluten-free diet can be extremely challenging. Many common and inexpensive American foods (e.g. pizza, bread, pancakes, pasta) typically contain gluten. Gluten-free alternatives can often be hard to find and/or quite expensive. Wild rice is a local, affordable and nutritious food option for tribal members with celiac disease.

The complexities of wild rice macronutrient and phytochemical analysis are discussed in the 2012 review paper Potential Health

Vitamin	Wild Rice	Brown Rice	Polished White Rice	Oats	Hard Red Winter Wheat	Corn
Vitamin A, I.U.	0	0	0	0	0	490
Thiamine, mg/100g	0.45	0.34	0.07	0.60	0.52	0.37
Riboflavin, mg/100 g	0.63	0.05	0.03	0.14	0.12	0.12
Niacin, mg/100 g	6.2	4.7	1.6	1.0	4.3	2.2
Vitamin C, mg/100 g	0	0	0	0	0	0

Table 4: Vitamin Content of Wild Rice and Other Cereals[37]

Benefits of Wild Rice and Wild Rice Products: Literature Review.[48] Much of the article's discussion is beyond the scope of this HIA. However, the review article included studies on health benefits of wild rice, including some experimental animal and human results.

One experiment described rats that were fed a diet containing 40% wild rice ground as flour and compared to a 0% wild rice control group. All rats were given a colon-specific carcinogen to induce colon cancers. After death, the rat colons were examined for pre-cancerous lesions. A trend toward lower precancerous lesions was seen in the wild rice-fed group. The authors suggest that the findings warrant further investigation.[40]

Additional animal experimental models (rats and hamsters) were summarized regarding the effect of dietary wild rice on a number of parameters that relate to potential cardiovascular risk (cholesterol, body weight, plasma leptin—a hormone correlated with degree of body fat, and adiponectin—a hormone that is inversely associated with insulin resistance). Insulin resistance is undesirable and is associated with diabetes, abnormal liver conditions and cardiovascular disease. Findings from all of the experiments described in the review article will not be fully discussed here, but several important discoveries are worthy of mention.

First, in rat experiments, dietary intake of wild rice significantly increased plasma adiponectin, suggesting that wild rice may have the capacity to diminish insulin resistance—a good thing. Secondly, in additional animal experiments, wild rice showed some cholesterol-lowering properties, and cooking the rice did not appear to blunt this capacity.

Lastly, in a 4-week controlled human feeding study providing cultivated wild rice to people with mildly elevated baseline serum cholesterol, no significant reduction in cholesterol was seen. Unfortunately, at the time of this HIA, no human feeding trials involving wild rice have been published in the peer-reviewed literature. There is tremendous opportunity for future study in this area.

Evidence suggests that wild rice is an impressively cardio-beneficial food source. As our nation grapples with lifestyle-related diseases of diabetes, heart disease, cancer and obesity, recent experimental models describe additional evidence of wild rice's anti-atherogenic and cardio-metabolically protective properties.[49,50,51,52] In more recent years, there has been a flurry of publications that characterize wild rice's ability to reduce damage to blood vessels associated with atherosclerosis (hardening of the arteries). Atherosclerosis can lead to heart attacks, sudden death, heart failure, kidney damage and strokes—diseases with high prevalence in indigenous people.

- In a 2013 publication of an experiment in mice, consumption of wild rice was shown to significantly reduce the size and severity of atherosclerotic lesions in the aortas (a large artery) of mice compared to control groups.[41]
- A 2012 study in rats using a species of wild rice native to China demonstrated rice's potential for preventing obesity and pro-

tecting the liver in the setting of high-fat/ high-cholesterol diets.[42]

- More recently in 2016, findings of the earlier 2013 study were reinforced in another mouse study showing reduction in the size and severity of atherosclerotic lesions in the aortas of mice fed wild rice when compared to controls.[43]
- And a 2017 study[44] demonstrated that in a mouse model, wild rice inhibited a series of immune and inflammatory responses in cardiovascular tissues of the mice when compared to control group. This inhibition is believed to be cardio-protective and may suggest a potential mechanism by which wild rice provides cardiovascular risk reduction.

These recent studies are exciting, but studies and interventions with humans are needed.

Wild rice can be substituted for other cereals and carbohydrates (potatoes, white rice) in a wide range of foods including soups, salads, desserts, breakfast cereals and casseroles.[37] As shown on Table 5, wild rice demonstrates a lower glycemic index than other forms of rice.[40] Foods with a lower glycemic index are considered to be more beneficial for blood sugar control, and as a result can reduce risk of diabetes, cardiovascular disease and obesity. A food with a glycemic index < 55 is considered a low glycemic index food. Conversely, a food with a value > 70 is considered a high glycemic index food. Though measurement of glycemic indices can vary widely, Table 5 provides some general comparisons of glycemic indices between types of rice. Canadian wild rice has the lowest glycemic index of the listed rice varieties.

Given the prevalence of diabetes, insulin resistance and cardiovascular disease in Minnesota's Native American population, wild rice's comparatively low glycemic index may offer a significant health advantage over other foods.

If wild rice is no longer as available or affordable to tribal members as it is now, what foods might be substituted for wild rice? Though speculative, it is reasonable to assume that replacement choices may be carbohydrates (such as potatoes, white rice, and pastas) given the availability, affordability and palatability of these foodstuffs. These foodstuffs tend not to be as nutritious or health protective as wild rice. Native Americans already suffer from disproportionate rates of diet-related diseases. Therefore, the potential negative health effects of non-wild rice food substitutions may be significant.

In addition to wild rice's cultural importance, wild rice's overall nutritional content is superior to other types of rice. It is high in protein, fiber and vitamins and has a low glycemic index. It is similar if not superior to other types of cereals, and may confer cardiovascular benefits. Eating less wild rice and potentially more less-nutritious foods is likely to contribute to the already high rate of obesity, diabetes, and cardiovascular diseases in the Ojibwe population.

Item	Glycemic Index (glucose = 100)
Wild rice (from Canada)	59
Calrose brown rice (Australia)	87 ± 8
Calrose white rice (Australia)	83 ± 13
Instant rice	69 ± 12

Table 5: Glycemic Index for Wild Rice and Other Forms of Rice[40]

Wild rice health benefits: Psychological value

Because we like it so much it makes us happy when we eat it. Happy feelings are good for your emotional health, plus it's a very good, healthy, and nutritionally complete food.

The actions of rice harvesting, preparation, gifting and eating promote social engagement and are not solitary activities. The significant mental health benefits of participating in traditional food gathering practices, such as harvesting wild rice, are discussed in the following section of the HIA.

However, it is important to note that a burgeoning weight of scientific inquiry is recognizing the important interplay between mental and physical illness. On a population level, common chronic medical disorders, such as diabetes or coronary artery disease, are not as well controlled in people with mental health diagnoses, such as anxiety or depression, as compared to people without mental health issues. [53]

Therefore, it is important to acknowledge that physical and mental health benefits of preservIing wild rice may be more than simply additive. Instead, it is likely that a synergistic benefit exists between the psychological and the physical health benefits of wild rice. Health improvements and attendant health cost savings are amplified as traditional food systems are strengthened.

3.2.3 Cultural, Spiritual, and Mental Health

Now I am capturing, acquiring, learning, loving what my culture really means. It is important to me being it is something that I can do. I can plant, I can grow, I can watch, I can harvest, share, nurture, feel a connection, feel the strength of generations past and for those to come, it is good. I can do this and be thankful.

Defining "health" for many American Indian people encompasses a holistic view that human health is associated with one's physical, mental, and emotional status, and includes factors of how one interacts with the environment and potential spiritual effects on health.[54,55] These interrelated components can be viewed as important individual drivers of overall health embedded within and forming cultural ways in American Indian communities. In fact, growing numbers of researchers cite cultural factors as fundamental determinants of health, treatment, and healing for Indigenous communities.[56,57,58] This section of the HIA primarily summarizes literature that documents the associations between indigenous health, in particular mental, emotional and spiritual health, and manoomin as a critical and ubiquitous cultural, social, and spiritual resource.

Connections to land and food are key components of culture and health for many Ojibwe people.[59] Anishinaabe language, identity, customs, and place (including land and water) are deeply intertwined with spirituality and good health.[60] Thus, pathways that link environmental and ecological harm to negative impacts on human health are likely amplified for indigenous communities and are one important driving factor of health disparities.[61,62,] Manoomin loss in particular may exacerbate health inequities for Ojibwe communities given the reliance and key spiritual role wild rice has as a cultural food for the Anishinaabe. As described in previous Environmental Impact Assessments (EIAs), American Indians often bear disproportional negative impacts from environmental disruptions due to higher levels of consumption of natural resources needed for cultural activities.[55,63,] Here in Minnesota, there is also the added potential for infringement on treaty rights that reserve the right to gather manoomin and the right for self-determination.[64]

Historical Trauma & Losses

We should be the ones who set the water quality standards, no one else. We have generations of knowledge about the state of our waters and land. It's our spirituality, it's our self. Having the DNR or PCA set the standard instead of us doesn't make sense. We're the ones who live here and have a direct relationship with the resources. It's not fair to the indigenous people. We're affected most, yet we have the least say.

One widely cited concept from which to consider cultural and natural resource losses, including manoomin, is historical trauma. This term describes a range of intergenerational, cumulative experiences of trauma in American Indian (AI) communities, including forced community relocation, removal of children from families to boarding schools, prohibition of cultural and spiritual practices, land disposition, and environmental derogation including flooding, contamination of reservation lands by toxic materials, and so on.[65,66] Systems and policies that are historically rooted continue to impact AI communities today: chronic oppression includes continual attacks and disruption of cultural ways[67] and a failure to honor treaties and rights and responsibilities resulting from them. Such marginalization disempowers indigenous voices in decisions (e.g., regulatory protections for important natural/cultural resources) that continue to affect tribal people, lands and waterways, including disruptions to ecosystems necessary to maintain healthy and viable manoomin.

Historical trauma and losses, including environmental losses, are associated with depressive symptoms, grief, and anger for indigenous people.[68] Acculturation (cultural modification of an individual, group, or people by adapting to or borrowing traits from another culture) to Euro/Western cultures related to loss of traditional foods has been implicated in rising diabetes and obesity rates for American Indians.[69] Manoomin loss may also be an additional burden for the urban tribal population who already face increased rates of acculturation driven by lack of traditional food accessibility. Damages to cultural practices surrounding ma-

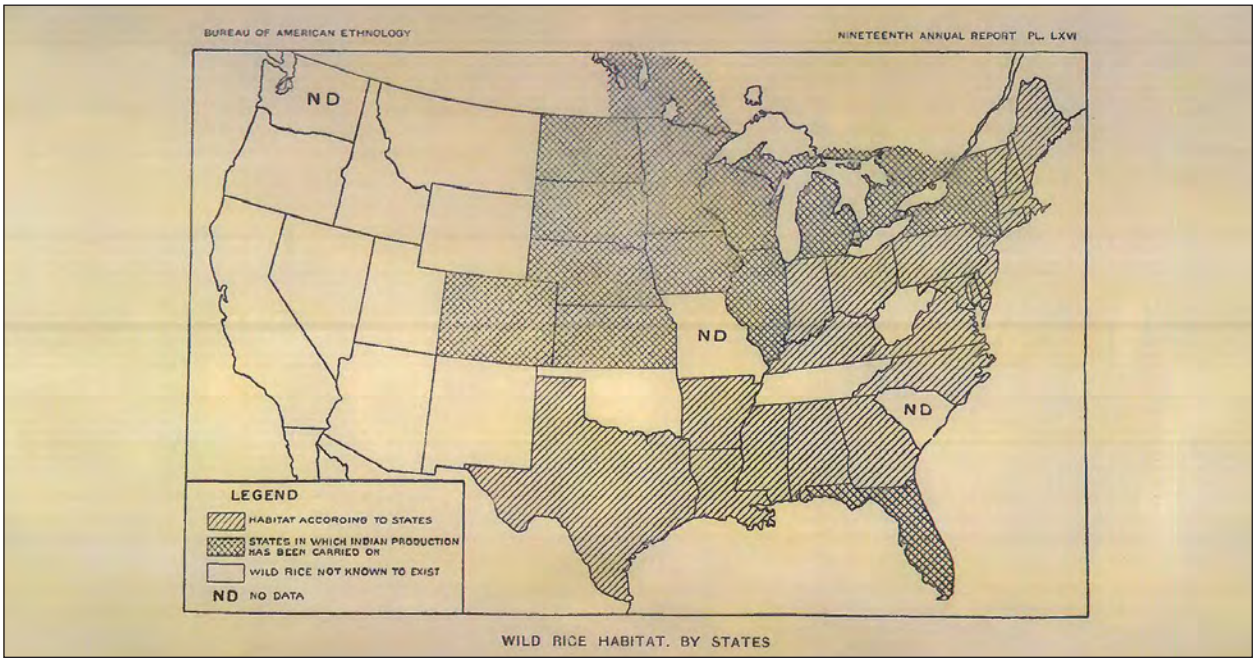


Figure 7: The historic distribution of Native American-harvested manoomin at the time of European contact[5]

noomin harvesting and/or loss of manoomin in Anishinaabe communities would harm social, economic, spiritual, physical, and psychological benefits related to these activities.[43,46,57] Decreased participation in culture, including ceremonies requiring food offerings and the rice harvesting process, may lead to traditional knowledge transfer disruptions and manoomin-specific Ojibwe language vocabulary loss.[42,,70] For the Fond du Lac community in particular, this may also inhibit current culture and language revitalization efforts and any potential health promotion.

Indigenous Culture and Health Promotion

If it isn't there, we can't eat it for our feasts. We will get depressed and sad. It's depressing because we can't have our spirit food.

Social and economic conditions are also identified as root causes of health disparities for American Indians, not only by adversely affecting health behaviors, but also by creating toxic stressors that physiologically harm the body.[46] On the other hand, protection, revitalization, and engagement in cultural traditions can promote Indigenous health. Our ability to quantify the potential impacts of culture and manoomin loss for Anishinaabe communities is limited by current conventional tools of assessment. For example, mortality and morbidity risks do not capture indigenous notions of wellness such as feeding the spirit.[46] Nuances of ceremonies, practices, and relational aspects of indigenous well-being are not adequately measured by existing tools; thus, research likely underestimates the potential protective and health-promoting impacts of indigenous cultural factors. Still, there is growing scholarly attention to wide-ranging aspects of enculturation, or the degree of engagement and/or embeddedness in one's traditional culture (e.g., Anishinaabe culture). Indigenous enculturation factors might include value systems, activity engagement, food systems, kinship networks, geographic location, spirituality, and language, to name but a few.

Cultural factors such as indigenous language fluency rates, participation in ceremonies and cultural activities, and connection to land are associated with better health outcomes.[71,72,5] For example, a study by Whitbeck and colleagues[73] found that youth who engaged in traditional practices including ricing were less likely to report depressive symptoms resulting from discrimination compared to youth engaged in fewer activities. In a separate study, engagement in traditional activities (including ricing) was associated with higher levels of flourishing mental health for a sample of Ojibwe adults living with type 2 diabetes.[74] Similarly, engagement in cultural practices and spending time in nature is associated with better mental and behavioral health.[75] Practicing traditional health activities is also significantly associated with disease protective behaviors.[76]

Conceptual Frameworks of Indigenous Culture and Health

For the same reasons—the season brings families together. To gather—to finish—to feast—to dance. That way the togetherness will create a healthy community.

Currently, a number of frameworks related to culture and health assessments explicitly reflect American Indian health. These frameworks were created due to shortcomings of risk assessments not accounting for cultural differences in health as well as inadequately addressing disparate negative environmental impacts for indigenous people. Frameworks have been developed to better assess the importance of cultural practices and connections

to land to health impacts such as religious practices, ceremonies, language fluency, ability to practice traditional activities and other measures of enculturation.[77,78] These frameworks have found positive associations between such activities and markers of health, such as lower rates of substance abuse, cardiovascular disease, and increased self-esteem and connection to community.

Resource management techniques emphasize cultural differences and the view that degradation of cultural events occur when ecosystems are disrupted.[63,48] These frameworks can also be used to assess enculturation and efficacy of health promotion programs based on culture [72,73,79,80].

3.3 Forced Socio-Economic Dynamic Changes

Keeping what's here. Scared about losing it.

In the Ojibwe community, to speak of natural resources and the environment is to speak of plants and animals, but also of livelihood, identity, spirituality, and culture. To say that Anishinaabe culture has eroded is to say, in part, that connections to natural resources have eroded. The Fond du Lac Band is endowed with substantial natural resources on the reservation and within treaty-ceded lands, but, paradoxically, Band members identify significant challenges connecting with these resources, as well as with social knowledge networks and their culture. These challenges, or disconnects, impede formation and sustainability of Ojibwe lives and livelihoods, and undermine the sustainability of Ojibwe culture. They also reflect historical trauma experienced by the community; notably, diminished intergenerational transfer of knowledge. These disconnects manifest as unsustainable natural resource use, reduced livelihood opportunities, food insecurity and poor nutrition, among other effects.[81]

3.3.1 Food Security and Food Sovereignty

We know we'll be okay if we go into July with 10-15 pounds of rice. It's nutritional and it's peace of mind for all of us.

Eating and gathering local foods is important to my family. Knowing where our food comes from, how it is grown and prepared is an important part of my family's health.

Various studies have focused on the physical and economic barriers to healthy eating and living in Native American communities, and these barriers include the lack of access to grocery stores, high cost of food, and poverty.

Food security can be defined as a state in which people have access to sufficient, safe, nutritious and culturally appropriate food. Access refers to both the physical availability or proximity to these foods, as well as the economic means to acquire them. According to the Food and Agriculture Organization of the United Nations statement at the 1996 World Food Summit in Rome, Italy:

Food security exists when all people at all times, have physical, social and economic

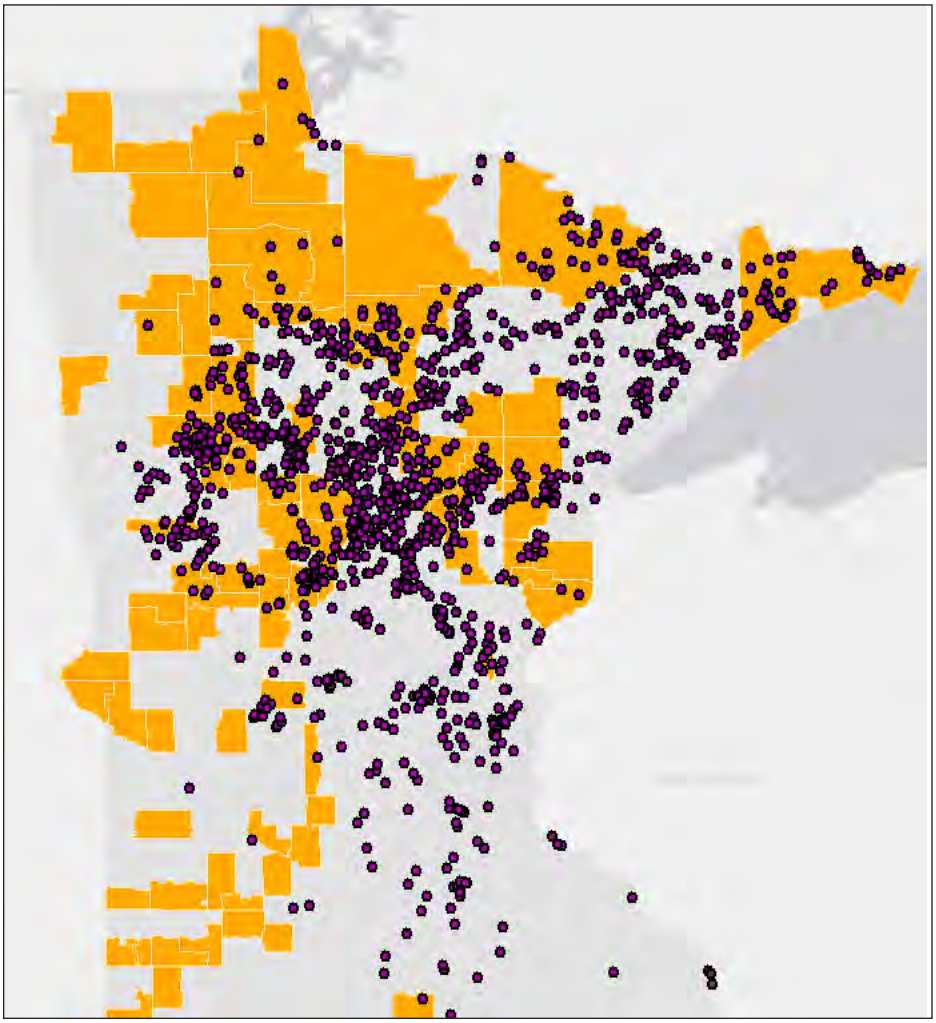


Figure 8: Minnesota Rural Food Deserts and State-identified Wild Rice Waters.

USDA defines a food desert as a low-income area where a significant number of residents live more than 10 miles from a big grocery store in rural areas, or one mile in urban areas.

The map shows rural food deserts identified by census tract (orange blocks) using 2015 data. The purple dots represent lakes and rivers identified by the MNDNR as supporting wild rice.

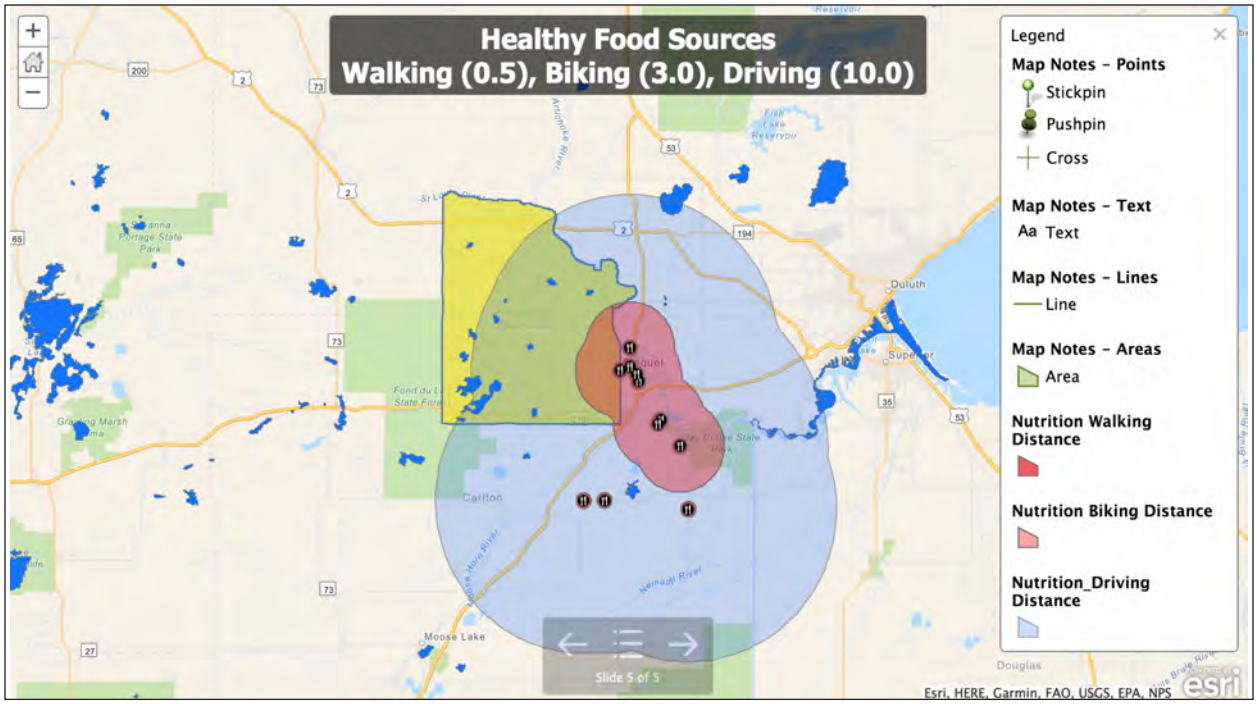


Figure 9: Healthy food sources near the Fond du Lac Reservation

access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and health life.[82]

Food desert is defined by the U.S. Department of Agriculture as a part of the country where access to fresh fruit, vegetables and other healthful whole foods is limited, largely due to lack of grocery stores, farmers' markets, and healthy food providers. While food deserts are short on whole (unprocessed) food providers, they are heavy on local quick marts that provide a wealth of processed, sugar- and fat-laden foods that are known contributors to the nation's obesity epidemic. To qualify as a "low-access community," at least 500 people and/or at least 33% of the census tract's population must reside more than one mile (in urban communities) from a supermarket or large grocery store. For rural census tracts like the Fond du Lac Reservation, the threshold distance is more than 10 miles. The Fond du Lac Reservation does not necessarily meet the criteria for designation as a food desert, but Band members have consistently expressed interest and desire in incorporating more natural, harvested foods in their diets.[83]

Food sovereignty is a term coined at the 1996 World Food Summit by La Via Campesina, a global movement of over 200 million small-scale farmers, peasants, farmworkers, and other food producers in more than 70 countries. Food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and the right to define their own food and agricultural systems. Harvesting what is naturally occurring and compatible with one's own environment is a key component.[84] Having enough good food to eat – food security – is but one element of food sovereignty, which involves controlling and managing all the factors that contribute to a sustainable food system: environmental quality, economic assets, cultural assets, and more.

Prior to European contact, the indigenous people of North America lived off the land and waters around them even in the harshest environments, building and passing along the wisdom gained from generations of learning how sustain themselves, their families and their communities. When people harvest,

process, prepare and serve native foods, they build strong relationships with the land and with each other.[85] But as tribal nations lost control of their homelands, in many cases they also lost connections to ancestral traditional knowledge about subsistence lifeways. After treaties were signed, the U.S. government began distributing annuity foods (pig fat, beans, flour, sugar) that were high in fat and salt compared to the traditional, healthy foods. This dietary shift led to poor health outcomes, but it was also a strategy for weaning indigenous people away from their reliance on the natural and traditional foods so that they could become "civilized."

The establishment of reservations also limited access to traditional staples and replaced them with less nutritious, more expensive, store-bought foods, leading to nutritional deficiencies and food insecurity that Native Americans experience today.[86] A history of displacing tribes and limiting access to traditional foods like manoomin has had profoundly negative and persistent impacts to Native American health and well-being. Numerous studies have shown that, for a variety of reasons, traditional foods reduce tribal food insecurity in ways that store-bought foods cannot.[87] Twenty-five percent of American Indians/Alaskan Natives are food insecure; more than twice the level of food insecurity experience by white Americans.[88]

According to the Traditional Plants and Foods Program of Northwest Indian College (Bellingham, WA), communities that exhibit *tribal food sustainability* and *food sovereignty* are those that:

- Have access to healthy food;
- Have foods that are culturally appropriate;
- Grow, gather, hunt and fish in ways that are maintainable over the long term;
- Distribute foods in ways so people get what they need to stay healthy;
- Adequately compensate the people who provide the food; and

- Utilize tribal treaty rights and uphold policies that ensure continued access to traditional foods.[63]

The health benefits of hand-harvested manoomin in Native American diets prevent a significant amount of food insecurity-related health care costs:

- Annual food insecurity-related health care costs for Native Americans in Minnesota are estimated to total $28.4 million in the state, or about $466 per person.

- People who suffer from food insecurity have been shown to accrue an average of $1,863 more in annual health care expenses than food secure individuals.

- Manoomin consumption among Native Americans in Minnesota prevents an average of $90,000 in food insecurity-related health care costs each year. (See Appendix A – Earth Economics report)

The current level of manoomin consumption adds up to $1.3-4.7 million worth of food that would need to be replaced with store-bought alternatives if it were no longer available. A 1% reduction in manoomin harvest would remove over 3,500 pounds of manoomin from the annual diets of the Ojibwe people in Minnesota.

For the Fond du Lac Band, the ability to exercise treaty harvest rights can further ensure our food sovereignty. Yet, even with those affirmed rights, band members are still at risk of losing the knowledge of how to practice hunting, fishing, and gathering because of historic and ongoing disruptions to social networks and traditional lifeways.

Access to sustainable populations of manoomin is critical for maintaining food security for Minnesota tribes, and is central to the affirmation of food sovereignty through exercise of treaty harvesting rights. If the availability or access to harvestable stands of manoomin is diminished, tribal members' health and sociocultural well-being will become further compromised.

The lack of food security that disrupted the food economies known by the Fond du Lac Band and other Ojibwe bands in the region…such as those that starved the people of Sandy Lake,[89] were an attempt to not only control where the Ojibwe lived, but control their local cooperative food economies across Michigan, Wisconsin and Minnesota… Each seasonal harvest varies from year to year across all resources: manoomin, hunting and gathering. We respond to this collectively by adjusting our location of harvest, storing up during good harvest years, and trading amongst ourselves to make sure we have what we need from year to year. Learning to save for the lean years is important; you do not want to be caught without when invited to ceremony, funeral feast, or when it's needed for an unexpected gift or by an Elder's request. This is Anishinaabe food security. As long as there is a resource of food, we can exercise our sovereignty and ensure our food security through our treaty rights and educate others on the importance of maintaining a healthy ecosystem for all people living in this region.[90]

Yesterday, it was with a birch bark canoe held together with spruce pitch; today, putting together a canoe is considered an art and used less for utility. Yesterday, we strung together nets with roots, used spears and little lodges on ice to catch fish; today, today we use boats and nylon nets ordered from the guy in Proctor. Yesterday, we collaborated with wazhashk (muskrat) and amik (beaver) to maintain water levels to ensure a good season of rice; today we use the dams left over from the early 1900s Army Corps (management), and muskrats are only talked about in stories. As delicate as all these relationships are they still change for us, year by year, administration by administration, and we still survive, the Anishinaabe and the manoomin...[88]

3.3.2 Economic Health

You're considered poor if you don't have a storage of wild rice.

Economic imbalance among citizens translates into inequity in access: to political leaders, to clean water, to recreational, spiritual and cultural resources. Those with financial wealth and political influence tend not to represent the full spectrum of perspectives, but are often able to advance their individual, not statewide, interests.[14] Until the early 1900s, the Ojibwe were the primary beneficiaries of the market for wild rice. But as agricultural mechanization and the movement to paddy rice production expanded, the Ojibwe were almost totally removed from any market profits.[91]

Yet this seasonal harvest of natural wild rice still provides important and significant economic benefits to tribal harvesters and the state's economy, as presented in the report prepared by Earth Economics for the Fond du Lac Band, *The Food that Grows Out of the Water: The Economic Benefits of Wild Rice in Minnesota* (Appendix A). Their analysis estimated the impacts of manoomin on economic activity, food security, and public health, and then estimated the changes in those impacts as a result of potential decreases in wild rice productivity. This report makes a compelling economic case for protecting the healthy ecosystems that manoomin requires, because of the myriad cultural, health, ecological and economic benefits of manoomin, including, for example, critical support for waterfowl migration and by extension, the waterfowl hunting economy. It acknowledges the linkage between manoomin and food security for Native Americans in Minnesota, and reduced health care costs because of its notable nutritional value.

Cultural values do not fit into an economic framework; their worth lies in a sense of place, personal and community identity, spiritual fulfillment, and other shared values that cannot be monetized. Those values are separate and distinct from economic gain or market values, and were specifically excluded from the economic analysis. However, in addition to the many ecosystem services provided by natural resources like manoomin, there are economic activities associated with them, and they are enormously valuable to our communities. Manoomin harvesters spend money in local businesses, providing jobs and support to other businesses. Manoomin also provides income for some tribal and state harvesters, and that income in turn is spent on rent, food, clothing, and more.

Manoomin is also an important part of the

IMPACT TYPE	EMPLOYMENT	LABOR INCOME	VALUE ADDED	OUTPUT
Direct Effect	116.9	$3,705,835	$4,631,752	$8,110,468
Indirect Effect	8.4	$532,438	$804,083	$1,499,982
Induced Effect	152.4	$7,313,718	$12,278,518	$21,418,720
Total Effect	**277.7**	**$11,551,991**	**$17,714,353**	**$31,029,171**

Table 6: Total economic contributions to the state economy of Minnesota associated with hand havvested wild rice

state of Minnesota's economy. However, these estimates are conservative underestimates of the actual economic impacts. The annual harvest results in $12.5 million in expenditures, and the sale of hand-harvested manoomin supports more than $19.2 million in annual income for tribal harvesters. The annual spending associated with manoomin harvesting (gas, equipment, supplies) supports about 153 local jobs, and the annual income generated by the sale of manoomin supports an additional 125 jobs. This translates to about the same dollar-for-dollar impact on the local economy as the residential construction industry in Minnesota. But under the scenario analysis of a 1% decline in manoomin productivity, even this small, seemingly insignificant decrease has measurable economic impacts.

Managing and restoring sustainable populations of manoomin across Minnesota supports economic security for tribal members and tribal communities.

3.4 Multiple Stressors on Manoomin

Wild rice needs clean, fresh water to grow and thrive. So do we. Water is life and wild rice is a part of a healthy life and environment. What is good for wild rice is good for all of us. We need to be the voice of the Manoomin! We need to be the voice of the water! We need to be the voice of the earth! We need to be a voice for each other!

3.4.1 Environmental Health/Ecosystem Integrity

While the cultural and sustenance reasons for protecting and restoring manoomin should be evident, natural wild rice beds also represent unique, valuable, and complex aquatic ecosystems, and support an abundance of wildlife and waterfowl. Where healthy stands of wild rice are present and sustainable, so are diverse animal and plant communities; the simple presence or absence of natural wild rice can be an indicator of broader ecosystem health and integrity.

Manoomin grows best in shallow waters, ideally 1-3 feet deep with soft, organic sediments. It generally prefers some moving water for growth, so inlets and outlets of

lakes, flowage lakes, and slow-flowing rivers are prime habitat.[92] It is an annual grass, germinating in the spring from seeds that fell into the water during previous years. A cool period with water temperature below 35°F for 3 to 4 months to sustain dormancy is required prior to germination. After germinating, the plant sends up its first leaves that float along the surface of the water before it develops more rigid upright stems and aerial leaves in early summer. The growing season is typically 110 to 130 days and depends on temperature and other environmental factors.

Manoomin plants begin to flower in mid to late July, as day length and temperature trigger development. The flowers are produced in a panicle or loose, branching cluster, with female flowers at the top and male flowers below. Pollination is primarily wind-driven, and cross-pollination between plants in the same stand is common and helps preserve the naturally high genetic variability. Seeds begin ripening at the top of flowering stems, taking several days to weeks for a single plant to complete ripening. Plants within the same stand or population will ripen at different times due to genetic and environmental variability. This staggered maturation process means that ripe grains can be available in a stand for several weeks, and across the statewide range of natural wild rice, for a month or more. It is also an important life history trait that ensures some seeds will survive adverse environmental conditions and be able to perpetuate the natural stand.

Viable seed may be present in sediments over long periods of time, and wild rice may re-establish after poor production years or reappear after long absences if environmental conditions improve. Tribal harvesters have for generations understood what recent experimental research has more recently confirmed: stands of natural manoomin undergo multi-annual cycles of productivity which can vary greatly.[93] This knowledge underlies the historic practice of harvesting different waterbodies across the region from year to year, tapping into the manoomin resources that are most productive in a given season and leaving less productive stands alone to reseed, reinvigorate, and provide forage for wildlife.

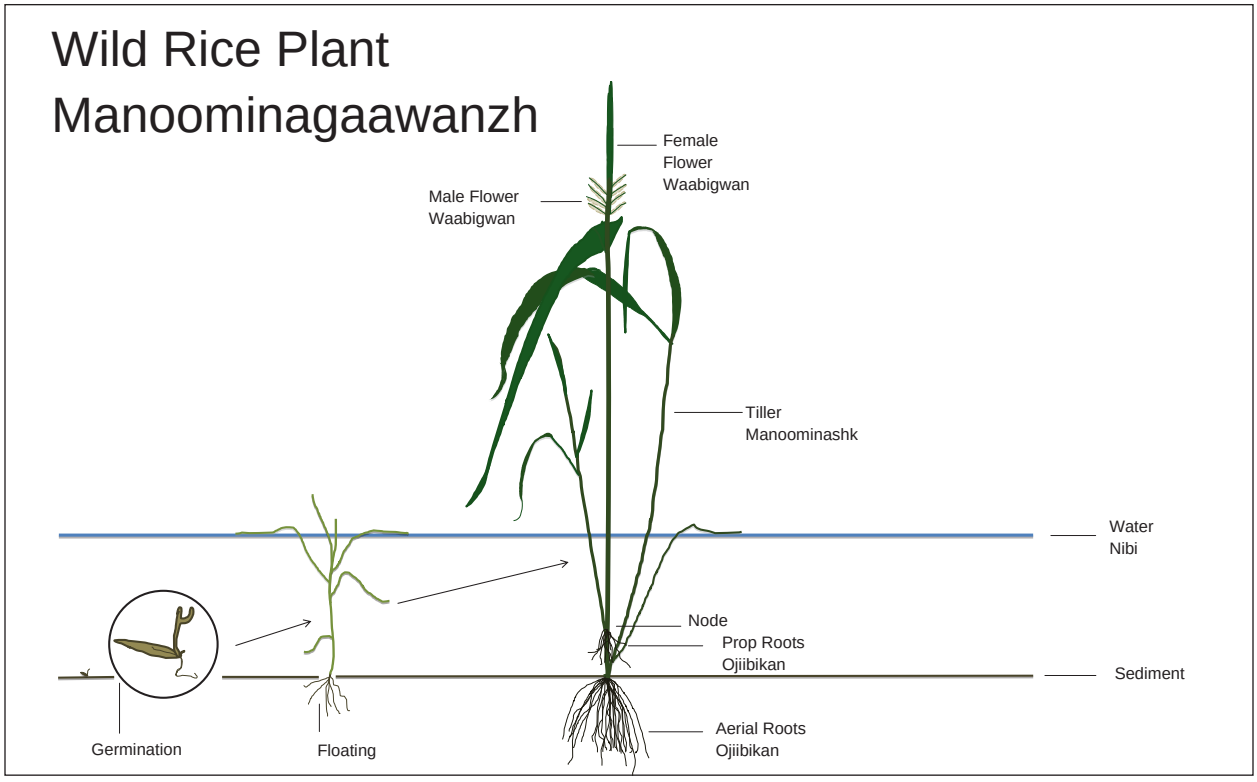


Figure 10: Diagram of manoomin plant at various life stages

Wild rice was historically abundant throughout the upper midwest, especially in Minnesota, Wisconsin and Michigan's Upper Peninsula, and in fact was once found in nearly every state east of the Rocky Mountains.[5] Figure 7 (page 39) shows the historic distribution of Native American-harvested manoomin at the time of European contact. Today, the range of natural stands of wild rice is profoundly diminished, due to multiple and cumulative effects of land use changes and altered hydrology, pollution, invasive species, and now global climate change. Manoomin is generally restricted today to the shallow lakes and slow-flowing streams and rivers of the Upper Great Lakes region.[94] But, as stated in the Minnesota Department of Natural Resources' 2008 report to the Minnesota Legislature:

Nowhere has natural wild rice been more important, nor had a richer history, than in Minnesota. No other native Minnesota plant approaches the level of cultural, ecological, and economic values embodied by this species. Natural wild rice has been hand harvested as a source of food in the Great Lakes region for thousands of years…

…The value of natural wild rice to wildlife has been long appreciated by American Indians and was marveled at by early European explorers. Research since then has documented that wild rice provides food and shelter for many fish and wildlife species. It is one of the most important foods for waterfowl in North America. More than 17 species of wildlife listed in the MNDNR's Comprehensive Wildlife Conservation Strategy as "species of greatest conservation need" use wild rice lakes as habitat for reproduction or foraging.[95]

Figure 11: Seven consecutive years of wild rice productivity on Dean Lake, Wisconsin. Photo courtesy of Peter David, Great Lakes Indian Fish and Wildlife Commission

The decline in stands of natural wild rice has been linked to modified hydrology, such as extensive ditching or channelization that drains a rice bed, or inundation from dams or industrial discharges that overwhelm the shallow-rooted plants. Aquatic invasive species, both plant and animal, can reduce vigor, stand density and rice production, and outcompete this annual grass for available habitat. Shoreline development can increase runoff, sedimentation and nonpoint source pollutants. Property owners remove aquatic vegetation, including manoomin, along their shorefront in order to "improve" views and water access, often without realizing that those "weeds" were actually wild rice. Multiple recreational uses of public waterways brings motorized boat traffic into wild rice beds, uprooting and tearing plants before they can set seed. Declining wild rice has also been linked to industrial discharges high in sulfate concentrations, such as from mine pit dewatering or seepage from tailings basins. Tribal harvesters and state harvesters of natural wild rice also have communicated grave concerns about impacts from genetically modified wild rice to the research community and state government, and have worked with the legislature to reach agreement on how best to protect natural wild rice while enabling the cultivated wild rice industry to improve production.

Although wild rice remains a significant cultural, subsistence, and economic resource for Minnesota, there are few regulatory protections in place. Ensuring the sustainability of this invaluable aquatic resource will require research and funding for effective restoration and habitat protection, and necessitates broader regulatory protections.

3.4.2 Climate Change

We didn't have enough rice after the 2012 flood. This made me thankful for rice in a different way. I hold tighter to it now, because I'm aware that I might not have enough. I don't want to feel this way, it's our culture to share our rice and take care of each other. It goes against who we are, to not have enough to take care of ourselves and our community.

Global climate change impacts superimpose additional, unpredictable and cumulative impacts to manoomin, beyond those impacts we can currently observe and measure: pollution, sedimentation, eutrophication, land use changes, habitat loss and degradation. The effects of global climate change are predicted to include changes to natural hydrology, and will likely aggravate existing impacts of development and land use changes on the unique and very specific hydrologic conditions that manoomin requires. Our region is already experiencing higher annual mean temperatures, higher mean winter temperatures, increasing precipitation and extreme storm events, changing seasonal patterns of precipitation, earlier ice-out dates and a longer freeze-free season. Over time these climate factors could lead to the elimination of manoomin from already-marginal habitat within its existing diminished range.

The Fond du Lac Band worked closely with the 1854 Treaty Authority, the Bois Forte Band of Chippewa and the Grand Portage Band of Lake Superior Chippewa on a climate change vulnerability assessment and adaptation plan for the 1854 Ceded Territory.[96] Manoomin was identified as a tribally important focus species that was both highly sensitive to climate change impacts and moderately lacking in adaptive capacity. In the vulnerability assessment, it was noted that manoomin requires a cold dormancy period before germination, which shorter ice-free

periods may compromise. High heat during late summer is thought to negatively impact pollination and seed development.

Manoomin is particularly sensitive to hydrologic changes, especially during the floating leaf stage in late spring when it can be easily uprooted by a "bounce" in the water level. High rainfall events can actually drown wild rice plants if water levels remain high for extended periods. The tribes identified concerns that increasing temperatures could affect manoomin through shorter/warmer winters (decreased germination because of shortened dormancy period that wild rice needs), warmer summers (less seed production), through aggravating the competitive advantage that invasive and native plant species have over manoomin, and through increased incidence of diseases (brown spot, ergot, stem rot) that are favored with increased warmth and humidity. Projections for increased precipitation and severity of storm events may result in more water level fluctuation and damage from heavy rains, high winds and hail.

Extreme drought conditions can also stress the plants, cause them to topple or, in some cases, reduce seed production. If drought persists for multiple growing seasons, exposed mudflats can promote the proliferation of hybrid cattail, phragmites and other invasive plant species. Once the plant community is converted to these species, wild rice may not be able to return without extensive intervention.[97]

One of the key management strategies identified for manoomin was simply to protect any and all remaining populations of wild rice, regardless of density. Other adaptation strategies include collaboration with the state resource management agency (MNDNR), consultation with state and federal agencies on development and enforcement of water quality standards, protecting wild rice habitats and

preventing the introduction of invasive species, expanding the monitoring and surveys of wild rice waters, increasing restoration efforts, and conducting education and outreach to the public about the importance of manoomin and the need to preserve it for future generations.

4. Conclusions and Recommendations

Living in a large family it was the best way my mom knew to give us a healthy meal, and it was one of those foods that would fill us up and last in our bellies 'til morning. We are very thankful.

Very important since the health of wild rice and wild rice waters affects all of us.

Wild rice is sacred food.

Persistence of American Indian Health Disparities

The persistent health equity shortcomings of American Indian are unambiguously evident in Minnesota. On average, people in Minnesota are among the healthiest in the country, yet American Indians are not as healthy as they should be. These health disparities persist and are neither random nor unpredictable. Native Americans experience double the rate of heart disease compared to other populations, higher rates of obesity, the highest rates of high blood pressure, cholesterol, and Type II diabetes of any racial group in the country, and are twice as likely to die from diabetes. Despite focused clinical efforts for nearly 20 years, FDL Human Services diabetes registry numbers continue to increase.

Causes of health inequities in American Indian communities are directly linked to determined and deliberate efforts of American federal, state, and local governments to uproot the American Indian people from their land, eradicate their languages, and destroy their way of life. First among these is the uprooting of the people from their traditional lands, a major factor that scientists recognize creates psychological and health impacts for generations. Displacement brought about a loss of traditional ways of making a living, of providing food for the table, and of being in relationships with one another. Diabetes rates are now endemic among American Indians throughout the U.S., including Minnesota, and the rise of these rates can be directly related to the introduction of food with poor nutritional value.

It is without doubt the American Indian diabetes health disparity in Minnesota is directly attributed to the disruption of traditional lifeways and the replacement of traditional foods with unhealthy government commodity foods. However, because this health inequity is socially determined, change is possible. Protection, revitalization, and engagement in cultural traditions can promote indigenous health. Cultural factors such as indigenous language fluency rates, participation in ceremonies and cultural activities, and connection to land are associated with better health outcomes. The physical activity associated with traditional food gathering, combined with the high nutritional value may offer great benefits to decreasing risks of chronic disease.

Access to sustainable populations of manoomin is critical for maintaining food security for Minnesota tribes, and is central to the affirmation of food sovereignty through exercise of treaty harvesting rights. Ensuring the sustainability of this invaluable aquatic resource will require research and funding for effective restoration and habitat protection, and necessitates broader regulatory protections. The following section identifies recommendations, both general and specific, which can lead to better health outcomes for Fond du Lac and other Minnesota tribal communities, and greater likelihood that manoomin will be protected and preserved so that future generations may also be sustained.

4.1 Recommendations/Strategies for Acton

1. Promote and support manoomin as a food option within existing programming: Elders Nutrition Program (ENP); Thirteen Moons; Women, Infants and Children (WIC) Nutrition Program; and the federal Supplemental Nutrition Assistance Program (SNAP) as well as other appropriate nutritional assistance programs.

2. Amplify existing efforts to communicate the benefits of wild rice for band members. Develop culturally relevant education programs to highlight the benefits of harvesting and consuming wild rice with the ultimate aim of sustaining and increasing wild rice consumption in band members.

3. Support inclusion of manoomin in a wide range of food-related settings: school cafeterias, skilled nursing facilities (nursing homes), assisted living facilities, hospitals, community events, festivals, summer camps, restaurants, farmers' markets, and grocery stores. Look for new opportunities to serve manoomin in the community.

4. Review the recommendations outlined in The Gwayakosijigan (Compass) project of 2013,[83] which identified children and new parents as ideal targets for new programming aimed at promoting healthy food habits. The Gwayakosijigan project's findings suggested that program emphasis on natural and traditional food types, sources, procurement and preparation may be highly effective in engaging the community to increase healthy lifestyle choices. Fortunately, educational resources already exist within tribal communities and can be utilized in future programming. An example includes *Mino Wiisinidaa! (Let's Eat Good!)* cookbook[98] which features original recipes from tribal elders featuring many traditional Anishinaabe foods with versions of recipes designed to help maintain a healthy diet. Existing tribal resources should be built upon and utilized.

5. Renew efforts to specify labelling of natural hand-harvested manoomin, as distinguished from cultivated paddy rice. Manoomin should be easily identifiable as a premium, healthy, unique local food, and there should not be any confusion in marketing language about the origin of natural hand-harvested manoomin. Many tribal members feel strongly that cultivated paddy rice should not be labeled "wild" rice.

6. Reinvigoration of tribal food systems, with the goals of increased food security and food sovereignty. This entails both on-reservation capacity-building for community food production and harvest of traditional foods and medicines, and off-reservation exercise of treaty harvest rights. While the Band has jurisdiction and authorities to protect on-reservation environmental quality, we will continue to press state and federal regulatory agencies to make decisions on land use and development that fully take into account the underlying need for clean, healthy ecosystems that support critical treaty-protected resources for current and future generations. Regulatory decisions that protect tribal treaty rights also protect the non-indigenous rights to land and healthy resources that the Band and other Native Americans ceded to the federal government and state of Minnesota through the treaties they signed.

7. Support and encourage tribal members to return to more traditional diet and activities. Continue ongoing tribal community efforts to promote health. Important steps could include establishing a more formal tracking system for the participation rates of Band members in traditional food systems, such as harvesting wild rice, as well as other hunting, fishing and gathering practices. Similar to successful community health initiatives in other rural Minnesota communities, such

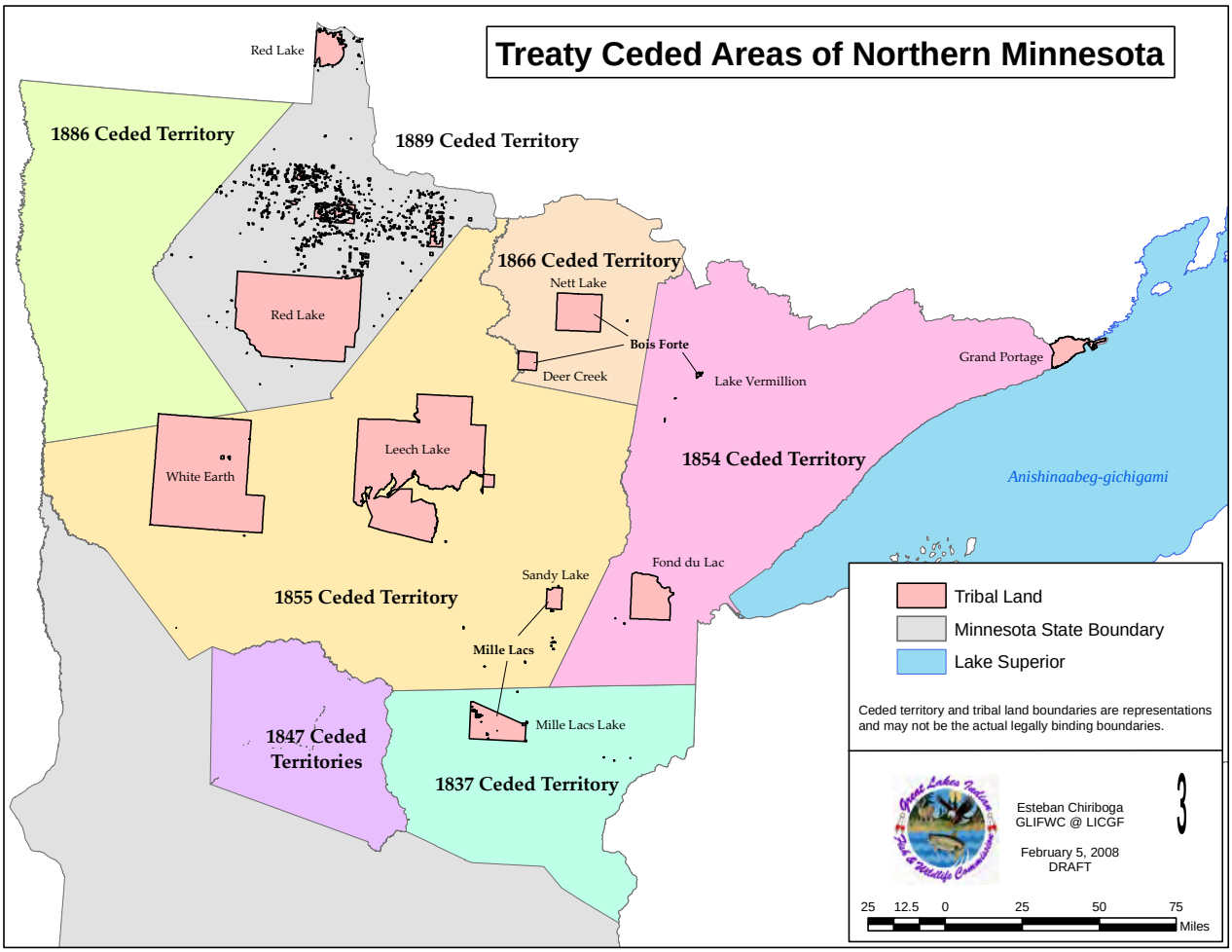


Figure 12: Map of ceded terrtories in northern Minnesota

as The Heart of New Ulm Project,[99] Fond du Lac community members and leaders can identify desired health behaviors and outcomes related to wild rice consumption. Programs and interventions to achieve the desired health improvements can be introduced.

Once programs are introduced, determining and tracking selected health metrics could be useful to assess progress toward improved population health. Specific metrics and outcomes would be chosen by the Fond du Lac Band, but examples include the following: blood pressure measurement, waist circumference, fasting glucose, cholesterol, incidence of dental caries, work absenteeism, and participation in tribal events.

Gathering interviews or surveys that ask ricers to recollect and rate the duration and intensity of activity could be helpful in establishing the fitness benefits of ricing. With the availability of wearable technologies, such as the FitBit® or a smart watch, more objective activity data can be collected. Such devices have already been utilized to quantify physical activity of tribal members in traditional activities such as dancing at pow wow. With individual rice harvesters agreeing to wear mobile devices, important physical exertion data could be collected.

8. Expand education/outreach activities and elevate public awareness about the ecological, nutritional, and cultural values of manoomin. This could be accomplished

through a variety of programs, including a statewide multimedia campaign that raises public knowledge of the uniqueness of the state grain and its nearly-exclusive presence in Minnesota.

9. Continue to promote and advocate for a comprehensive and protective regulatory framework specifically for wild rice waters. This framework would, by necessity, include both the MPCA through its Clean Water Act authorities: water quality standards, National Pollutant Discharge Elimination System permitting and enforcement, Clean Water Act §401 certification, and antidegradation determinations; and the MNDNR through its aquatic plant management permitting and enforcement, incentivizing and accelerating conservation easements, and through consideration of special designation and listing for management similar to trout streams and calcareous fens. The sensitivity of manoomin to human disturbance, combined with stresses imposed by climate change, warrant special designation for increased protection from pollution, shoreline disturbance, water withdrawals, and other activities controlled through MPCA and MNDNR permitting.

10. Implement a concerted and coordinated effort among state, tribal and federal agencies to inventory all existing Minnesota wild rice waters. This effort has been long promised to the tribes and recommended by both MPCA and MNDNR, but never realized. It is imperative that we have a common baseline inventory of wild rice waters before more stands disappear or degrade. Management, protection, and restoration efforts all depend upon this collective understanding of the current status of manoomin resources in Minnesota.

11. Implement a coordinated and standardized approach for assessing the condition of wild rice waters in Minnesota. State and federal agencies and academia should adopt the method published by Minnesota Sea Grant[100] that tribes across the Great Lakes (US EPA Region 5) are using to track manoomin annual stand density and biomass in order to assess the health and sustainability of manoomin across the region and over time. This monitoring and assessment, along with the inventory recommended, can be accomplished through the state's existing watershed-based monitoring and assessment program with a relatively small investment of additional funding.

12. Encourage and support citizen science and volunteer monitoring programs targeting manoomin, similar to long-term volunteer monitoring programs like the statewide lake and stream volunteer monitoring programs. Citizen science can be a way to create close ties between scientists, managers, and the community. Consult with the St. Louis River Watch and tribal elders to determine research questions, and couple the citizen science effort with outreach to promote wild rice monitoring. Results and information can be shared at community events. This action would provide opportunities to expand surveillance, foster a greater sense of responsibility and concern throughout the state, and promote tribal/non-tribal relationship building via a common objective: to protect and sustain manoomin for future generations of Minnesotans.

4.2 Opportunities for Continued Research

1. Study climate change impacts (temperature, hydrology, extreme weather events) to manoomin populations on top of other anthropogenic impacts and assess cumulative effects on manoomin.

2. Study factors affecting seed development. A variable percentage of seeds produced by a wild rice plant never develop endosperm; they remain empty. More research is needed to understand the factors that affect this interrupted reproduction, including pollination studies and research into plant diseases and pests.

3. Conduct research into effective methods for controlling waterfowl predation on existing stands and areas in restoration.

4. Further health and nutrition studies:

   - Wild Rice Consumption Data and Correlations to Health Outcomes

     Collection of comprehensive data is needed for tribal members in all age groups about the accessibility, frequency, amount (number of servings per month) and social context of eating wild rice. With this information, additional research can investigate possible correlations between wild rice consumption and other favorable physical and mental health outcomes.

   - Wild Rice's Impact on Diabetics and on the Glycemic Response

     Acknowledging that diabetes is a common disorder, additional research on human glycemic (blood sugar) response to consumption of wild rice is important. Does consumption of wild rice improve diabetes control when compared with other carbohydrates? Can adverse events, such as heart attacks or strokes, be reduced in diabetics by eating more wild rice? Could eating wild rice provide more generalizable benefit to pre-diabetics and help with diabetes prevention in the community?

   - Cancer Prevention

     Based on emerging data, research should continue about the potential for wild rice to reduce the risk of colon cancer as well as other kinds of cancers.

- Impact on Dentition

  Investigate if there is a correlation between more traditional diet (that includes manoomin) and lower rates of tooth decay, missing teeth, filled teeth, gingivitis and denture use. A hypothesis could be tested whether people who consume less wild rice would replace the rice with higher sugar-containing foods—correlating to increased tooth decay risk.

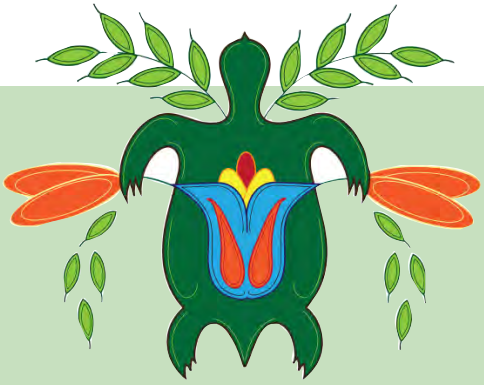
- Impact of sulfate/sulfide exposure on manoomin's nutritional qualities

  Currently, it is unknown how the nutritional composition of wild rice is affected by increasing aqueous sulfate exposure during the plant's seasonal growth. Future research should study whether the physiological health benefits of eating wild rice are altered by ingesting rice grown under higher aqueous sulfate conditions.

- Conduct infant/pediatric studies about wild rice nutrition for early childhood and potential connections to dental health, good growth and development.

4.3 Evaluation and Monitoring

MDH performed a pre-HIA survey to assess the knowledge of HIA Steering Committee members of HIA. The pre-survey also captured suggested goals for the HIA. MDH will perform a post-HIA survey to determine if there has been a change in knowledge and to assess the HIA process overall. Results of the HIA process evaluation, as well as a review of the HIA goals, will be shared with the HIA Steering Committee members. Lessons learned from the HIA may be presented at relevant state, tribal and national conferences, as approved by Fond du Lac. Additionally, Fond du Lac will develop a monitoring plan for the HIA so that staff can determine if any of the recommendations are implemented and if the implemented recommendations make a difference in tribal health. For more information on the evaluation and monitoring of the HIA, contact Fond du Lac Resource Management Division.



5. Acknowledgements

This project was made possible by the efforts and commitments of dedicated staff at Fond du Lac Resource Management, the Minnesota Department of Health, our partners on the HIA Steering Committee, and graduate students at the University of Minnesota School of Public Health. We relied primarily upon existing personnel resources and expertise, with no Health Impact Assessment project-specific external funding except for the contractual funding generously provided by the Fond du Lac Reservation Business Committee to augment our assessment with an external economic analysis.

Chi miigwech to all who shared their time and knowledge, enabling us to share the Fond du Lac Band's perspectives and concerns for sustaining manoomin, and to the Thirteen Moons program for contributing to publication costs for the final report.

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Appendix A:

Earth Economics Report, *The Food that Grows Out of the Water: The Economic Benefits of Wild Rice in Minnesota*, found at the Fond du Lac Band of Lake Superior Chippewa website, fdlrez.com

Appendix B:

Steering Committee Meeting Agendas and Participants, found at the Fond du Lac Band of Lake Superior Chippewa website, fdlrez.com

Appendix C:

Content analysis results about the importance of wild rice (Manoomin) to the health of the Fond du Lac Band of Lake Superior Chippewa to inform the Fond du Lac Collaborative Health Impact Assessment Baseline Health Assessment, found at the Fond du Lac Band of Lake Superior Chippewa website, fdlrez.com

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